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# Reference H Piloted Assessment (LaRC.1) Pilot Briefing Guide

E. Bruce Jackson, David L. Raney, David E. Hahne, and Stephen D. Derry Langley Research Center, Hampton, Virginia

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## Introduction

This document describes the purpose of and method by which an assessment of the Boeing Reference H High-Speed Civil Transport design will be evaluated in the NASA Langley Research Center's Visual/Motion Simulator. Six pilots will be invited to perform approximately 60 different Mission Task Elements that represent most normal and emergency flight operations of concern to the High Speed Research program.

The Reference H design represents a candidate configuration for a High-Speed Civil Transport, a second generation supersonic civilian transport aircraft. The High-Speed Civil Transport is intended to be economically sound and environmentally safe while carrying passengers and cargo at supersonic speeds with a trans-Pacific range.

This simulation study is designated "LaRC.1" for the purposes of planning, scheduling, and reporting within the Guidance and Flight Controls super-element of the High-Speed Research program. The other major Guidance and Flight Controls simulation experiments referred to in this document are described below:

- LaRC.0 This was the first full-envelope assessment of the Reference H design. LaRC.0 was conducted at NASA Langley Research Center in the Visual/Motion Simulator in December 1995 using Cycle 2B release of the Reference H simulation model.
- TIFS.1 This experiment involved flight of the Air Force Wright Laboratories Total In-Flight Simulator aircraft, a modified C-121H with variable stability and control capability. It was conducted by Calspan Corporation in Buffalo, Nw York during May 1996.
- Ames.1 This was an evaluation of different longitudinal control response types. Ames.1 included a longitudinal control power criteria study. Ames.1 was conducted in the NASA Ames Research Center Vertical Motion Simulator in June 1996 using Cycle 2B release of the Reference H simulation model.
- Ames.2 This simulation experiment compared three control inceptors: wheel & column, center stick, and sidestick in the Ames Vertical Motion Simulator using the Cycle 2B model. It was conducted in the fall of 1996.

The present experiment, LaRC.1, will include the latest control laws from industry partners Boeing and McDonnell-Douglas. These control laws will include an evaluation of envelope protection algorithms for the first time in a Reference H piloted assessment. In addition, an evaluation of the effect of the vehicle's structural dynamics (due to the inclusion of a model of the aeroservoelastic modes of the flexible structure) upon flying qualities in selected maneuvers will be conducted.

[Note: When originally distributed as an information document to participating test pilots in advance of the study, this document was written future tense. In an effort to make minimal changes, the future tense was kept in this revision which includes grammatical corrections and minor clarifications and style changes to fit the formal NASA publication series.]

#### Nomenclature

m.a.c.	Mean Aerodynamic Chord
AGL	Above Ground Level
CDU	Cockpit Display Unit
CG	Center of Gravity

CHR	Cooper-Harper rating
CRT	Cathode-Ray Tube
DME	Distance Measuring Equipment
DIA	Denver International Airport
EAS	Equivalent Airspeed
HUD	Heads-Up Display
HSCT	High Speed Civil Transport
HSD	Horizontal Situation Display
IAG	Niagra Falls International Airport
I.C.	Initial conditions
LaRC	Langley Research Center
$\mathbf{M}_{mo}$	Maximum Operating Mach Number
MTE	Mission Task Elements
MTOGW	Max Takeoff Gross Weight
MZFW	Max Zero-Fuel Weight
OEO	One Engine Out
PF	Pilot Flying (evaluation pilot)
PFD	Primary Flight Display
PIO	Pilot-Induced Oscillation
PLR	Programmed Lapse Rate
PNF	Pilot Not Flying (test engineer)
RFLF	Recovery from Limit Flight
RTO	Rejected Takeoff
SPD	Surface Position Display
SSB	Simulation Systems Branch
TOGA	Takeoff/Go-Around
TIFS	Total In-Flight Simulator
VHD	Velocity/Height Display
V Wmin	Minimum Operating Speed
V mo V MCA V MCG V MCL-2 V MCS	Maximum Operating Speed
V <sub>MCA</sub>	Minimum Control Speed, air
V <sub>MCG</sub>	Minimum Control Speed, ground
$\mathbf{V}_{MCL-2}$	Minimum Control Speed, landing, two engines out
A IATO	Visual Motion Simulator
V <sub>r</sub>	Takeoff Rotation Speed
$\mathbf{V}_{1}^{'}$	Takeoff Decision Speed
$\mathbf{V_2^1}$ $\mathbf{X}\mathbf{V}\mathbf{S}$	Takeoff Safety Speed
XVS	Enhanced Vision System

# **Purpose of Assessment**

The 1997 Piloted Reference H Assessment test at NASA Langley will be performed using the Boeing Reference H simulation model (Cycle 3). The purpose of the assessment is to evaluate and quantify operational aspects of the model from a pilot's perspective.

This study (LaRC.1) is the second full-envelope assessment of the Reference H model; the first was conducted at Langley in the fall of 1995 and focused upon the vehicle's basic configuration with little regard to the control system. This assessment will include the latest control laws, known as the W, or "gammadot-V," longitudinal law and the  $p\beta$ , or "p-beta," lateral/directional law. In addition, this assessment will contain the first evaluation of certain envelope protection features of

these latest control laws as well as an evaluation of the effect of the vehicle's structural dynamics (due to inclusion of the aeroservoelastic modes of the flexible structure) upon flying qualities in selected maneuvers.

Other simulation studies of the Reference H model have been conducted, both piloted and in batch analysis, including simulation evaluations by Boeing, McDonnell-Douglas, Calspan, and NASA Ames Research Center. This is the first assessment of the Cycle 3 release, however.

## Ref. H Configuration notes

## Cycle 3 model origins

This LaRC.1 test will be based upon the so-called "Cycle 3" version of the aircraft mathematical model. This was published by Boeing Commercial Aircraft Group in the summer of 1996 as the fourth major release in a series of increasingly detailed math models of the Reference H design. The Cycle 3 release has improved-fidelity models for aerodynamics, inertia, engines, landing gear, and actuation systems. The model includes quasi-elastic flexible aerodynamic effects and actuator hinge moments and an engine inlet model that predicts and models the supersonic inlet unstart phenomena. This unstart capability will be a factor in the assessment.

The simulation model is based upon a combination of wind tunnel and computational fluid dynamics studies of the Ref. H design, ranging from low subsonic to 2.4M supersonic wind tunnel studies. In addition, finite-element structural models have been evaluated for strength, rigidity, and flutter dynamic predictions; information from these computations are used to predict the effect of steady flight loads upon aerodynamic stability derivatives.

The Cycle 3 model has been modified from the original release by a series of revisions. The LaRC.1 study will include revisions A, B, C and D to Cycle 3.

Some additional modifications have been made in the implementation of Cycle 3, including the inclusion (for selected maneuvers) of aeroservoelastic (flexible) structural modes. These modifications attempt to capture and recreate the effects of vehicle structural flexibility upon the pilot's flying qualities due to additional higher frequency motion of the cockpit caused by turbulence and pilot inputs to the control system.

## General specifications

The design vehicle (Reference H) is approximately 310 feet long with a wingspan of approximately 130 feet and has a MTOGW of 650,000 lb. and a MZFW of 350,000 lb. The fuselage has a maximum diameter on the order of 12 feet, and is expected to carry approximately 300 passengers in three seating classes.

## Aerodynamics

The Ref. H vehicle design has a cranked-arrow planform, a conventional aft tail, and four underslung engines. The control devices include a geared horizontal stabilizer and elevator, a three-segment rudder on a fixed vertical fin, eight wing trailing-edge flaperons, four leading-edge flaps, a "vortex fence" device and two "spoiler-slot deflectors" on each wing (see figure 1).

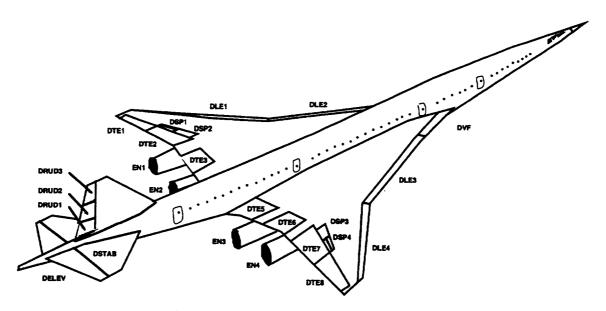


Figure 1. Reference H general arrangement

## Operational Concerns

The need to operate within the existing airspace system mandates that the HSCT mix with subsonic traffic in the terminal environment and operate at subsonic speeds. This requires the design to fly most approaches on the "backside" of the drag curve - that is, an increase in power is required to trim for a decrease in speed. This unconventional throttle activity would require extensive retraining of flight crews to successfully accomplish; however, this "backside" characteristic can be masked by using a fairly high-bandwidth autothrottle system. During the LaRC.1 study, landings will be performed with and without autothrottles active.

Noise concerns have caused the examination and design of automatic flap deployment schedules on takeoff and landing maneuvers. Also, a Programmed Lapse Rate (PLR) takeoff procedure has been devised to schedule the autothrottle system during takeoff. This maneuver was investigated in the 1995 assessment. These aspects of the Ref. H design will be further explored in this test.

A fuel-optimal climb and descent profiles that include loft and pushover maneuvers have been designed to meet target range goals. These will be examined in the LaRC.1 study for operational feasibility.

It is anticipated that an operational HSCT will include some enhanced vision system to avoid having to lower the nose for landing. While during this test the visual scene presented to the pilot is not fully representative of an enhanced vision system, the display will include symbology superimposed on the forward view that is similar to proposed XVS symbology. The forward field-of-view is shown at lower resolution and in a smaller field-of-view than that proposed for the operational XVS, however.

The geometry of the Ref. H configuration has been modeled in the simulation so that an accurate assessment of tailstrike, nacelle strike, and wingtip strike can be made during takeoff and landing operations.

#### Control Laws

The simulation model used in the LaRC.1 test will use control laws that feature flight path rate command/flight path & airspeed hold  $(\dot{\mathcal{W}})$  in the longitudinal axis, and a roll rate/sideslip command & bank angle hold system  $(p\beta)$  in the lateral-directional axes. These laws were developed by Boeing and McDonnell-Douglas, respectively, and have been implemented in the Langley simulation model. These control laws are designed to provide (1) stabilization and control authority over several flight regimes and (2) rudimentary autoflap/autothrottle capability sufficient to perform the various tasks in the LaRC.1 tests. Comments regarding these control laws are encouraged; unlike the previous LaRC.0, evaluation of these control laws is now part of the purpose of this test. Envelope protection features (overspeed and alpha limits) have been added to the flight control system for this test, and will be studied in various maneuvers.

#### Control Surface Function Allocation

The method of utilizing the available control surfaces for various flight control functions is described in Appendix C.

## **Propulsion**

The engine model included in the Cycle 3 simulation allows for varying levels of detail on engine and inlet operations. At the highest complexity level, the engine inlet simulation reacts to flight conditions that could cause an inlet unstart in supersonic flight on one or more of the four engines being simulated. In general, the inlet is sensitive to small changes in freestream velocity angles - that is, a sudden and non-trivial change in either sideslip angle or angle of attack will cause (usually) the outboard engines to unstart at cruise conditions. The LaRC.1 test will explore the impact of this sensitivity as well as simulate a "ripple" unstart situation in which an inboard engine failure causes the neighboring outboard engine to unstart. Several engine failures in subsonic flight will also be evaluated.

The Ref. H design includes two mixed flow turbofan FE21/F15-A17 engines under each wing, capable of 97,000 lb. of gross thrust each. The axisymmetric inlet includes a translating centerbody spike to adjust the location of the shock wave at cruising speeds.

The outboard engines are located 31.2 feet from the centerline of the aircraft and are canted inward at 2.4 degrees and upward 3.25 degrees relative to the centerline of the aircraft. The inboard engines are located 17.4 feet from the centerline and are canted inward 1 degree and upward 5.7 degrees.

## Landing gear

The landing gear design modeled in the Cycle 3 simulation consists of three sets of main gear, located just behind the center of gravity envelope and arranged in left, center, and right sets of tires abreast of each other, and a nose gear. The main gear are located approximately 156 feet behind the cockpit and have an 17.7 ft stance. The nose gear is located approximately 56 feet behind the cockpit. Turning angle of the nose gear is 75 degrees.

## Center of gravity and loading envelope

The Ref. H design has an operating empty weight of 280,000 lb. and a maximum taxi weight of 650,000 lb. Final cruise weight is expected to be 385,000 lb. The center of gravity can vary from as far forward as 48.1 % mean aerodynamic chord (m.a.c.) to as far aft as 56.6 % m.a.c. Various LaRC.1 tasks will be flown at these extremes as well as intermediate values of weight and CG as appropriate for the task.

# **Langley Visual Motion Simulator**

## Cab arrangement

The Langley Visual Motion Simulator (VMS) is the original synergistic hexapod motion system. The current cockpit configuration includes a left seat Pilot Flying (PF) station and a right seat Pilot Not Flying (PNF) station. A throttle quadrant with four throttles is located between the pilot stations and includes a Cockpit Display Unit (CDU) that will be utilized in the LaRC.1 tests to monitor and adjust various functions of the simulation. A fold-down jump seat is located behind and slightly to the left of the PNF station for an observer. The PNF has two rheostats to adjust cockpit ambient lighting. Four-point harnesses are provided at all seats for motion operation.

## Inceptor (left side stick)

The inceptor (controller) to be used for all LaRC.1 tests in the Langley VMS is a McFadden left-handed side stick. The PF seat includes a left-side armrest that is adjustable to provide appropriate forearm support for the left arm of the evaluation pilot.

## Visual projection

An Evans & Sutherland ESIG-3000 visual image generator is used to provide out-the-window scenery onto four mirror-beam-splitter monitors: a left and a right side view, and two forward views (one for each pilot). The terminal environment used for takeoff and landing work is a representation of Denver International Airport (DIA). To assist the landing tasks, "desired" and "adequate" landing boxes will be drawn on the image of the primary runway (DIA 35L), along with a target landing reference stripe to either side of the target touchdown aim point.

## **HUD & other display formats**

A simulated Heads-Up Display (HUD) is provided through an electronic video mix with the forward view. Appendix A contains a schematic of this HUD format, which was developed for LaRC.1. Six other CRT displays are provided in the cockpit, arranged to the front and side of either pilot, in addition to the CDU. These displays provide a heads-down Primary Flight Display (PFD), a Horizontal Situation Display (HSD), and a Velocity/Height Display (VHD). It is anticipated that the PFD and HSD will be somewhat familiar to the evaluation pilot; the VHD display was developed for the LaRC.1 test and provides profile climb/descent trajectory information as well as a display of the Ref. H Vmo/Mmo envelope as a function of altitude.

In addition, two specialized displays will be used in the LaRC.1 study: a Surface Position Display (SPD) and a trim display; these are used to monitor the wing flap positions and the engine thrust levels, as well as to ensure proper configuration of the autothrottle and landing gear positions prior to each simulation run.

A scorecard display is also provided at the completion of each run to indicate the numeric value of certain metrics during the run to assist the evaluation pilot in assigning pilot ratings to the various tasks.

#### Motion characteristics

The motion platform will provide up to  $\pm 0.6$  g acceleration cues vertically within a 5.75 foot travel envelope; lateral and longitudinal acceleration limits are similar. The angular limits of the Langley VMS are  $+30/-20^{\circ}$  pitch,  $\pm 32^{\circ}$  yaw, and  $\pm 22^{\circ}$  roll. (Positive pitch is in the nose up direction.)

Motion cueing will be enabled for the majority of the tasks. Table 1 indicates the use of motion cueing for each task.

## Test elements

#### Task list

The following tasks will be evaluated by each pilot during the LaRC.1 tests:

#### Takeoff Tasks

- Rejected takeoffs
- Standard acoustic profile takeoff
- Alternate acoustic profile takeoff
- Programmed lapse rate takeoff
- Minimum control airspeed ground
- One engine out takeoff (no wind and crosswind)

#### Landing Tasks

- Nominal approach and landing
- TIFS offset approach and landing
- Go-arounds
- Crosswind (15, 25, 35 knot) landings
- Circling approach and landing
- Decelerating approach and landing (autothrottles on and off)
- Minimum control airspeed landing (two engines)

#### Airwork Tasks

- Level-off from climb transonic and supersonic
- Profile climb
- Profile descent
- Initiation of climb subsonic
- Airspeed change subsonic climb and subsonic, transonic and supersonic cruise
- Heading change 5 flight conditions
- Stall series (symmetric and asymmetric power)
- Diving pull-out
- Emergency descent
- Inadvertent speed increase recovery supersonic
- Two axis upset recovery supersonic
- Minimum control airspeed airborne (V<sub>MCA</sub>)
- Inlet unstart

#### Failure Tasks

Landing with jammed stabilizer

- Landing without stability augmentation system
- Landing without autothrottle
- Flaperon hardover on takeoff
- Elevator hardover on takeoff
- Flaperon hardover during two-axis upset recovery
- Elevator hardover during two-axis upset recovery
- Autoflap failure during go-around
- Flaperon hardover during crosswind landing
- Elevator hardover during landing
- Degradation of roll power during crosswind landing
- Rudder hardover during landing
- Rudder hardover during landing rollout

#### Task notes

Refer to Appendix B for the flight cards describing each of the tasks. Table 1 can be used as a cross-reference between flight card number and title, which may be of assistance in using the following notes.

#### Takeoff Tasks

The takeoff tasks included in this comprehensive full-envelope Ref.-H assessment are designed to exercise the aircraft/pilot/control system over a wide range of scenarios. Maneuvers that are included in this segment are rejected takeoffs (RTOs), one-engine-out (OEO) continued takeoffs, and a series of noise abatement procedures. Maneuvers 1050, 1052, 2010, 2011, 2030, 7035, and 7036 are included in this block. In addition, a maneuver to determine the minimum control speed on the ground  $(V_{MCG})$  is also included, but will not be evaluated by all pilots since it is more of a control demonstration than a handling quality maneuver.

#### Rejected takeoff maneuvers (tasks 1050 and 1052):

The two RTO maneuvers are designed to evaluate the aircraft's ability to remain controllable while experiencing maximum braking. They simulate the need to reject the takeoff due to an engine failure occurring immediately before reaching the decision speed. Prior to commencing each maneuver, pilots are briefed regarding what to expect. This removes the "surprise" factor of the RTO, but does provide the means to carefully evaluate the scenario. The main pilot's task is to keep the CG of the aircraft within the specified bounds for lateral distance from runway centerline using rudder pedal inputs alone (i.e. differential braking should be avoided, or at least noted if it was used). Maneuver 1050 is performed without cross-winds whereas maneuver 1052 has 35 kt cross-winds. Incorporation of the cross-winds was intended to expose any possible control power deficiencies that might exist.

## One-engine-out continued takeoff maneuvers (tasks 7035 and 7036):

To complement the RTO maneuvers, two one-engine-out (OEO) continued takeoffs are included in this block. For these maneuvers, the #4 engine (as shown in figure 1) is failed at a speed just above the decision speed (V<sub>1</sub>). This requires the pilot to continue the takeoff. OEO takeoff maneuvers are terminated at approximately 6.0 nautical miles from brake release which provides enough time for the pilot to achieve stabilized flight with the asymmetric thrust condition. Maneuver 7035 is performed without cross-winds whereas maneuver 7036 has 35 kt cross-winds. Maneuver 7036 is probably the most difficult takeoff maneuver to successfully perform due to prob-

lems with striking various parts of the aircraft on the ground. Once airborne, however, the pilot's task is not very difficult.

As was the case for the RTOs, the OEO continued takeoffs only have one evaluation segment. When the aircraft is on the ground, the pilot's tasks is to keep the aircraft within specified lateral limits (±10 feet for desired, ±27 feet for adequate performance). At V<sub>r</sub>, the pilot is to follow the rotation guidance (maneuvers 2011, 2030, 7035, 7036) to perform a consistent, smooth rotation for lift-off. At V<sub>r</sub> -5 kts, the pitch rotation guidance brackets (see the HUD description section) become visible and the reference waterline is doubled in size. At V<sub>r</sub>, the rotation guidance brackets begin to move vertically with respect to the reference waterline. They indicate the instantaneous level of pitch rotation error. The rotation guidance brackets are driven to command a 1.5 deg/sec<sup>2</sup> pitch rate acceleration, a 3.0 deg/sec steady rotation rate, and if need be, a 2.5 deg/sec<sup>2</sup> pitch rate deceleration. Pitch rate is arrested only if a tail strike becomes imminent. Desired performance is achieved when the pitch rotation rate error is less than 0.5 deg/sec for 90% of the time. For adequate performance the pitch rotation rate error is increased to 1.0 deg/sec for 90% of the time. In addition to the pitch rate error brackets, a tail strike bar is also included. Once airborne, the pitch rate error brackets, and the tail strike bar are removed from the HUD display.

The pilot's airborne task is to follow the velocity vector guidance symbol. It provides lateral and longitudinal guidance information. Laterally, it provides guidance to follow the extended runway centerline. Longitudinally, it provides guidance to intercept and maintain the desired climb speed. Additionally, a minimum climb gradient (3%) is commanded when the aircraft is unable to accelerate at the specified rate to preclude too shallow of a climb gradient. Desired performance is to keep the commanded velocity vector within one velocity vector diameter of the guidance symbol 90% of the time. Adequate performance is achieved when the commanded velocity vector is within two diameters of the velocity vector guidance symbol 90% of the time.

This criteria may be conceptualized by two imaginary boxes centered around the velocity vector guidance symbol that are three velocity vector symbol diameters in width and height for the desired performance box and five velocity vector symbol-diameters in width and height for the adequate performance box. The goal is to keep the velocity vector within that imaginary boxes 90% of the time. (The metrics for each performance standard are calculated and displayed to the pilot at the conclusion of each run).

In addition, the pilot is to attempt to reduce the sideslip angle to zero using rudder pedal inputs and the sideslip indicator (again, see the HUD description section). No performance metrics are established regarding sideslip excursions.

#### Acoustic takeoff maneuvers (tasks 2010, 2011, and 2030):

There are a total of three noise abatement maneuvers included in this evaluation. They represent different ideas regarding noise abatement strategies. Maneuver 2010 is designed to be as similar as possible to what was performed during the previous simulation study at NASA Ames Research Center (Ames.2). Automatic flaps are active for this task. Thrust is manually advanced at the beginning of the takeoff, but is then switched to autothrottles during the single thrust cutback at 700 feet. The maneuver violates many FAA FAR regulations and is probably the least realistic noise abatement takeoff maneuver of the three. The pilot's task is very simple. On the ground, the pilot's task is the same as OEO takeoffs, except that no rotation guidance is provided. The only significant on-ground pilot performance metric for maneuver 2010 is that the lift-off pitch attitude be close to 10 degrees. Once airborne, the pilot is required to establish an 8 degree flight path. Given the fact that a flight path command system is employed for this study, this is almost a non-task. At 700 feet, the PNF will reduce the desired flight path to 2.5 degrees, using the CDU, and engage

the autothrottles. The pilot's task is to adjust the flight path angle to follow the new desired flight path. There are performance metrics on bank angle and heading which are fairly easy to satisfy. Maneuver 2010 has two evaluation segments. The first segment extends from brake release up to just prior to the thrust cutback. The second segment covers the thrust cutback and the subsequent climb.

One of the least desirable features of this maneuver is that during the initial climb segment, airspeed is increasing rapidly and becomes as much as V2+40 kts. When the autothrottles are engaged to hold V2+10 (212 kts) the thrust is commanded to idle for an extended period of time (as much as 10 seconds in initial evaluations).

Maneuver 2011 was designed to be a takeoff maneuver that an HSCT might employ under current regulations. Therefore, flaps remain fixed at their initial position (LEF=30°/TEF=10°) and thrust is a manual task performed by the PNF. The pilot's task is the same as the OEO takeoff maneuvers (tasks 7035 and 7036). One obvious difference is that a single thrust cutback is performed at 700 feet, whereas no thrust adjustments were made for the OEO takeoff maneuvers. The thrust cutback is intended to be a little more gradual than what was performed for task 2010 which reduces normal acceleration excursions during the maneuver. Since thrust is a manual task, no extreme thrust excursions are encountered, unlike maneuver 2011.

Maneuver 2030 is the most radical noise abatement procedure and offers the maximum reduction of noise suppression required to meet the new proposed Stage-3-X regulations. Noise regulations require that the takeoff noise at two points be below specified levels to gain certification. These two points are sideline noise and centerline noise. Sideline noise is the maximum level of noise measured along a microphone array parallel to the runway centerline and displaced 1476 feet to the side. Results for HSCT aircraft are that the maximum sideline noise is produced when the aircraft is at very low altitudes (approximately 100 feet). Thrust cutbacks performed above this altitude have no effect on the level of sideline noise produced. Sideline noise is also the metric that is the most difficult to meet. Typically, HSCT noise suppresser requirements are determined from sideline noise suppression needs. For this reason, a gradual initial thrust cutback to 75% of maximum thrust is initiated at lift-off. This has the effect of exposing the sideline microphone array with a reduced level of noise. For this maneuver thrust and flaps are under direct computer control. In addition, once airborne, the aircraft is allowed to accelerate up to 250 kts which provides improved aerodynamic performance and subsequently reduces the thrust required to maintain a given climb gradient. When the aircraft reaches 250 kts, the autothrottle system switches into an airspeed hold which has the appearance of being a second cutback.

The pilot's task for 2030 is the same as 2011, 7035, and 7036. The pilot performance metrics are lateral distance from runway centerline while on the ground and in performing the rotation guidance and velocity vector guidance tracking tasks. One apparent difference, however, is that the longitudinal velocity vector guidance is only providing a climb gradient target, which is the same as maneuver 2010. Again, as a result of the constant climb gradient combined with the  $\gamma V$  control system, pilot activity is significantly reduced. Additionally, since no large climb gradient changes are required, normal acceleration excursions are also greatly reduced.

#### Landing Tasks

A flight card showing the task definition and performance criteria for the Nominal Approach and Landing (Task 4020) is shown in Appendix B. The task begins in level flight at an altitude of 1500 ft and an airspeed of 190 kts on course for a 30-degree localizer intercept. The pilot uses the ILS localizer and glideslope displays on the HUD shown in Appendix A to perform the approach. At a DME indication of 7.0 NM, autothrottles are commanded to reduce airspeed to the final ap-

proach speed of 159 kts. The current procedure for use in the nominal approach includes an automatic reconfiguration of leading and trailing edge devices that is initiated at a gear altitude of 390 ft and is ramped in over a period of 18 seconds. The impetus for this automatic flap reconfiguration is the tradeoff between noise restrictions imposed in the terminal area and the desire to reduce the aircraft pitch attitude at touchdown. The nominal autoflap procedure therefore configures the aircraft for a low speed/ low noise approach down to an altitude of 390 ft at which point the vehicle passes a critical noise-measuring station. Flaps and leading edge devices are then automatically commanded to a high-lift low pitch attitude setting of 10 degrees (l.e.) and 30 degrees (t.e.) for the final flare and touchdown, thereby reducing the potential for tailstrike at touchdown. During this period, thrust is increased by approximately 12% and pitch attitude is reduced by approximately 6 degrees to compensate for the flap change. When performing the approach and landing with autothrottles engaged, these changes will occur automatically. When autothrottles are disengaged during the approach and landing, as in the Manual-Throttle Landing (Task 7095), the pilot must advance the throttle levers to compensate for the autoflap reconfiguration which is initiated at 390 ft. A sketch depicting the landing task segment definitions and performance criteria is shown in figure 2.

A Decelerating Approach procedure (Tasks 4220 and 4225) is also being considered as an alternative to the nominal autoflap procedure that has been used to date in the HSCT piloted simulation assessments. This procedure would address several of the concerns associated with the current autoflap procedure, but may also introduce some new issues of concern which the pilot will be asked to enumerate. The decelerating approach will be initialized with the aircraft trimmed at 185 kts instead of the 159 kts used in the nominal approach. This speed will be maintained through glideslope capture, and the aircraft will then follow a deceleration profile designed to bring the airspeed down to 159 kts at the runway threshold. The procedure will allow the use of lower throttle settings during the approach, which should help to address airport and community noise concerns. The procedure also permits the automatic flap transition to be initiated at a higher altitude and to occur less abruptly than in the nominal approach and landing. Pilot comments regarding the acceptability of the decelerating approach procedure are of particular interest. The task will be performed first with autothrottles (Task 4220) and then under manual throttle control (Task 4225).

Crosswind landings (Tasks 4093 and 4095) will also be included in the assessment. One issue to be addressed during the assessment is to define an appropriate decrab procedure for this aircraft. The 25-knot crosswind landing (Task 4093) will be performed using each of the two candidate procedures (A and B) shown on flight card 4093 included in appendix B. The pilot will be asked to declare a preference for one of the two procedures and then to use that procedure to perform the 35-knot crosswind landing (Task 4095). This approach will provide subjective data regarding pilot preference as well as quantitative data in terms of the touchdown performance that each pilot achieved using their preferred procedure. Pilots will also be asked to offer suggested improvements to either of the two decrab procedures.

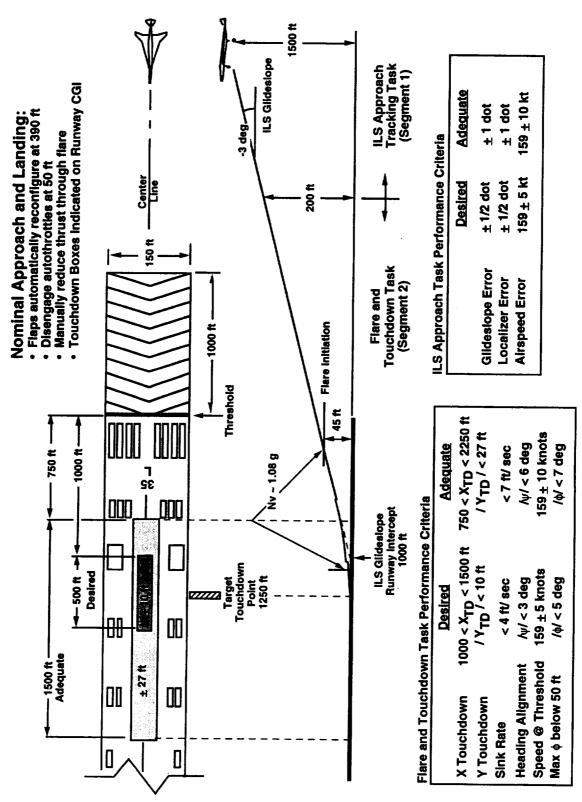


Figure 2. Task definition and performance tolerances for nominal approach and landing.

A new task that has been defined for this assessment is a Circling Approach to Denver International's runway 26 (Task 4140). This task was developed based on pilot comments which reflected a desire to evaluate the aircraft and control system handling qualities in a low-altitude highworkload environment where the pilot may find it necessary to maneuver extensively in close proximity to the ground. The aircraft is initially trimmed at 159 kts on an ILS approach to runway 35R at altitude of 1500 ft with a ceiling of 1000 ft and visibility of 7 NM in a 35 kt crosswind. Upon breakout, the pilot is asked to perform a circling approach to Runway 26 while maintaining a minimum altitude of 750 ft. No head-down NAV display is available for use with this task, so a recommended circling approach profile consisting of a series of turns scheduled with DME is shown in figure 3.



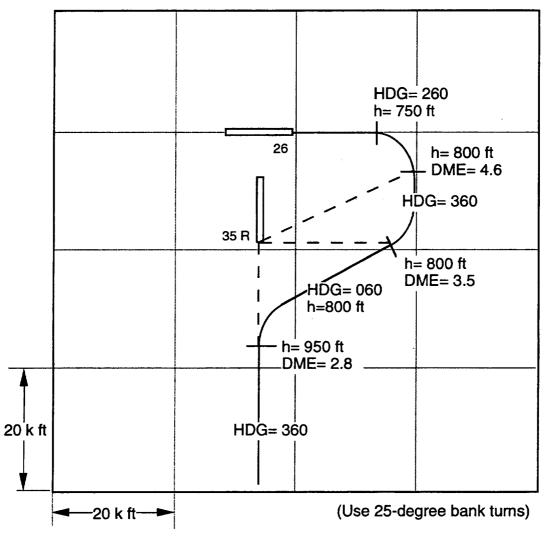


Figure 3. Recommended circling approach profile from Denver International's runway 35R to runway 26 for use in task 4140.

The task is somewhat artificial in that there is no such approach procedure specifically prescribed for use at Denver International. It is also unlikely that the pilot of an HSCT would perform such a circling approach rather than simply executing a missed approach. Nevertheless, the task provides an opportunity for pilots to assess the current vehicle model in a critical VFR operating environment.

Other approach and landing tasks that will be included in the assessment are the IAG Offset Approach and Landing (Task 4069), a Go-Around initiated at gear heights of 50 ft and 30 ft (Tasks 4086 and 4085), and a demonstration of the minimum approach speed for recovery for two-engine failure, Dynamic  $V_{MCL-2}$  (Task 4050). Flight cards showing procedures and performance criteria for each of these tasks are included in appendix B.

#### Airwork Tasks

The LaRC.1 airwork tasks include a variety of maneuvers representing both normal operation and possible certification procedures.

Included in these up-and-away tasks are simple maneuvering tests (heading changes, climbs, level-offs, descents, and accelerations/decelerations) in a variety of flight conditions. More complex manuevers, including stall recovery and certification procedures, are included.

Certification maneuvers, including recovery from a two-axis upset, dive, and overspeed at cruise conditions, will be evaluated. A demonstration of dynamic  $V_{\text{MCA}}$  will be performed. An emergency descent from cruise conditions following a simulated explosive decompression will be evaluated. The result of a loss of thrust on an inboard engine and an inlet unstart on that engine, with a sympathetic inlet unstart on the neighboring outboard engine, will be demonstrated. An inlet unstart envelope depiction on the HUD symbology will be evaluated.

Profile climbs and descents may be demonstrated, using flight path director guidance to assist the pilot in following the preplanned profile.

The stall maneuvers, also known as recovery from limit flight (RFLF) maneuvers, are designed to test the aircraft's controllability at extreme angles of attack. All aircraft are required to demonstrate that a certain margin exists between normal operational speeds, such as those used for takeoff and landing, and the speed at which the aircraft stalls. Conventional aircraft demonstrate the stall maneuver by increasing the angle of attack until the classical nose-down type of stall characteristics are encountered. Unfortunately, HSCT aircraft stall at angles of attack considerably beyond the angle of attack at which control is lost. Using the theoretical stall speed in this application would produce hazardous results since the aircraft can never fly to, and recover from, a stall condition. Instead, for HSCT applications, a maximum angle of attack demonstration maneuver is employed. The maximum angle of attack is determined from the desired approach speed and weight and applying the appropriate safety margins. For the Ref.-H, the maximum demonstration angle of attack is approximately 21 degrees. Therefore, all of the RFLF maneuvers require the pilot to maneuver the aircraft to 21 degrees angle of attack, then recover.

Upon maneuver initialization, the pilot's task is to follow the HUD guidance to slow the aircraft down at approximately 1.0 kt/sec. All RFLF maneuvers are performed with fixed thrust. HUD guidance includes a biased acceleration arrow and also a velocity predictor bar (see Appendix A) as part of the airspeed tape display. The acceleration arrow indicates inertial acceleration of the aircraft along the flight path. If the acceleration arrow is aligned with the velocity vector (below 15 degrees angle-of-attack) a 1 kt/sec deceleration is achieved. Once the angle of attack is increased

above 15 degrees, the acceleration arrow moves up to the reference waterline so that it remains visible to the pilot. The velocity predictor bar indicates what airspeed would be achieved in 10 seconds at the current acceleration rate. As such its length will be approximately 10 kts long when a 1 kt/sec deceleration rate is being maintained. Given the fact that the aircraft becomes extremely airspeed unstable as the angle of attack is increased, maintaining a constant deceleration rate becomes difficult. Therefore, it is suggested that only loose tracking of the acceleration be attempted while operating at angles of attack greater than approximately 17 degrees to avoid PIOs. In addition, an angle of attack tape display is provided.

Recovery is initiated as soon as the angle of attack reaches 21 degrees. For the non-turning RFLF maneuvers (5010, 5020, and 7070) the pilot's task is to lower the nose and stabilize at approximately 13 degrees angle of attack without encountering any large bank excursions (desired performance is bank angles less than ±5.0 degrees, adequate is ±10 degrees). The turning RFLF maneuvers (5040, 5050, and 7080) require the pilot to level the wings since these maneuvers involve a 30 degree bank angle entry. Bank angle performance limits for the turning RFLF maneuvers apply to the recovered bank angle (i.e. wings level) and are the same as the non-turning RFLF maneuvers. No bank angle overshoots are allowed for the recovery to the wings-level condition. In addition, pilot comments regarding the aircraft's perceived recovery capability are highly encouraged.

#### Failure Tasks

All of the failure tasks that will be evaluated during this assessment of the Reference H configuration will be no worse than Hazard Class II (i.e. all will be controllable and non-catastrophic). Failures will be inserted into several of the standard takeoff, landing, and cruise flight cards and will use the same metrics as the base tasks from which they are derived. Failures will be evaluated in a separate block and the pilot will know what type of failure to expect and when it will occur. The purpose of evaluating these failures will be to assess whether a minimum of Level II handling qualities can be maintained despite problems with the flight control system and/or flight controls and not the pilot's ability to respond to an emergency situation.

Tasks 7211 and 7212 (see Appendix B) are based on the Standard Acoustic Takeoff task (2010) with a flaperon hardover and elevator hardover (30° trailing-edge down) respectively. The flaperon hardover (trailing-edge flaps 1 and 8 deflected 30° asymmetrically) (see figure 1) occurs after rotation but prior to liftoff. The elevator hardover occurs at 100 ft AGL and requires the pilot to request that the leading- and trailing-edge flaps to be reconfigured in order to maintain a positive rate-of-climb. The pilot-not-flying will reconfigure the flaps to zero deflection.

Five failures will be evaluated during precision landings. All of the failures, except task 7254, will occur at 300 ft AGL while on short final. Task 7252, an elevator hardover (30° trailing-edge down), does require that the pilot request that the leading- and trailing-edge flaps be reconfigured. The pilot-not-flying will reconfigure the flaps to the TOGA settings. Two of the tasks involve rudder hardovers: task 7253 (rudder panel 1 30° hardover) occurs at 300 ft AGL; task 7254 (all rudder panels 30° hardover) occurs at main gear touchdown. The later task requires the nose wheel to be on the ground in order to maintain positive directional control. The final two precision landing tasks occur with a 15 knot crosswind. Task 7291 reduces the travel of trailing-edge flaps 1, 2, 3, 6, 7, and 8 to between 15° and 30° (a 75% loss of roll control). Task 7292 is a hardover of trailing-edge flaps 2 and 7 (30° asymmetric). As with the basic crosswind landing tasks there will be two different decrab procedures that can be used for these evaluations.

Failures at supersonic cruise conditions will also be evaluated. Using the 2-axis upset as the base

task (task 6060), both an elevator hardover (30° trailing-edge up) and a 30° asymmetric hardover of trailing-edge flaps 3 and 6 will be examined. These are tasks 7261 and 7262 respectively. These tasks will be evaluated with an engine complexity of 5 (i.e. the engines can unstart) and with unstart envelope guidance.

Finally, a go-around with trailing-edge flaps jammed at landing deflections (task 7286), a landing starting outside the outer marker without stability augmentation in all axes (task 7100), and a landing starting outside the outer marker with the stabilizer jammed at 0° (task 4110) will be evaluated. These last two task were initially evaluated during the previous Reference H assessment. The tasks themselves have not changed but the aerodynamics, metrics, and reference speeds have been updated for this evaluation.

## Flight card description

The typical flight test card includes task definition, including flight phase, Mission Task Element (MTE), weather, failure, and loading conditions, initial conditions for the run, target airspeeds, etc. A narrative procedure for performing the evaluation of each task is provided. Up to three different evaluations are desired for each task; these evaluation segments are described on the flight card along with performance standards. Finally, a space is provided for written comments noted by the PNF for each task. Appendix B contains a copy of the flight cards to be tested. Table 1 summarizes the task list of all flight cards.

## Data collection

## Pilot experience

Each evaluation pilot is requested to provide a brief biography of flight experience for inclusion in any reporting of results.

## Pilot ratings

The familiar Cooper-Harper rating (CHR) scale will be utilized for most LaRC.1 tasks. Copies of the Cooper-Harper ratings chart will be available in the cockpit and are available on request.

#### Audiovisual records

In addition to the CHR ratings, evaluation pilots are encouraged to provide narrative comments both while performing the tasks and at the conclusion of each evaluation. Both the out-the-window/HUD image and pilot comments will be recorded for post-test analysis and transcription.

#### Data records

A digital record of selected simulation parameters will be made for each run. Data collection will be at least 4 Hz and will be 8 Hz for most runs. Some of these parameters are analyzed on-the-fly during the run and selected information concerning maximum deviation from target values will be available on the pilot score card display.

## Strip charts

24 channels of certain parameters will be recorded on traditional strip chart machines as back up to the data records.

## **Test Protocol**

#### Test schedule

Simulation sessions are arranged so two pilots can be accommodated over the course of a week. It is expected that the two pilots will alternate sessions, so a two-hour-on, two-hour-off work schedule will be used. Each pilot will be briefed prior to the simulation session to make the session more efficient.

The actual number of simulation sessions required to evaluate the full test matrix will depend upon the pace most comfortable to the evaluation pilot. Barring unforeseen hardware problems, there should be ample time to look at the 40 or so higher-priority tasks during the course of a single week.

#### Daily schedule:

7:30 - 7:45	Sim team briefing
7:45 - 8:00	Pilot briefing
8:00 - 10:00	1st session - pilot A
10:00 - 12:00	2nd session - pilot B
12:00 - 13:00	Lunch
13:00 - 15:00	3rd session - pilot A
15:00 - 17:00	4th session - pilot B

## Motion base operation

The operation of the VMS motion platform will be under the supervision of Simulation Systems Branch (SSB) personnel. They will brief each participant on motion base safety and contingency plans prior to the first motion session. Each participant will be required to complete a health questionnaire and indicate that they have received this briefing prior to the initial motion session.

A key interlock is used in the cockpit to indicate the occupants are all ready to begin motion operations.

## Cockpit responsibilities

The PNF will be responsible for preparing the cockpit for each particular MTE and operating the landing gear switch. The PNF will record pilot comments in summary form on each flight card as well as any CHRs provided by the evaluation pilot. The PNF will record the run number, date, and pilot on each flight card and annotate the voice record with the same information at the beginning of each run. The PNF will be provided with a microcassette recorder and encouraged to record the evaluation pilot's comments at the end of each series of runs as a backup to the voice record. The PNF will serve as the communicator to the simulation operations console and test conductor, located in the real-time flight simulation facility control room, and will control the operation of the simulation by calling for "hold", allowing the motion platform to reach initial conditions, and then "operate" to begin each task. The PNF will call for "reset" at the completion of each task.

The evaluation pilot (Pilot Flying) will be tasked with performing each task as outlined in the flight cards and render pilot ratings and other evaluation comments as appropriate. The evaluation pilot will also be responsible for ensuring all motion cockpit occupants are ready to begin motion operations and turning the keylock to allow motion system to activate.

## Console responsibilities

The Real-Time Console operator will configure the simulation for each task and introduce appropriate failures and weather states as required for the task under the direction of the test conductor.

## **Test Conductor**

The Test Conductor, located in the control room, will track the progression through the test matrix, maintain the run log, and operate the audio-visual recording devices. The Test Conductor will assure the various tapes and strip charts are labeled with date, pilot, and run numbers.

# **Bibliography**

- 1. Dornfield, G. M., et. al. "High Speed Civil Transport Reference H Cycle 2B Simulation Data Base", Contract NAS1-20220, Task Assignment No. &, WBS 4.3.5.2, July 1995
- 2. Churchill, Brett, et. al. "High Speed Civil Transport Reference H Cycle 3 Simulation Data Base", Contract NAS1-20220, Task Assignment No. 36, WBS 4.3.5.1.2.1, June 1996

# TABLE I. TASK LIST AND EXPERIMENT CROSS-REFERENCE

Cord	Sag	Tools		Aero-	) ( - e'	Used	n Previo	ous Expe	riment
	No.	Task ID	Flight Card Name		Motion Cueing	LaRC.0	TIFS.1	Ames.1	Ames.2
Block	٠1.	Take	offs and Stalls			<u>.</u>			
2.00		ililariz							
1	1		Standard acoustic takeoff	Off	On	√.			
2	2 T-1		Nominal Approach & Landing	Off	On	$\checkmark$			
_	Take								
3	1		Standard acoustic takeoff	Off	On	,		√	$\checkmark$
4	2		Standard acoustic takeoff	Off	On	√,			
5 6	3	2030	Acoustic (Prog Lapse Rate) takeoff	Off	On	√,			
7	4		Refused Takeoff	Off	On	٧,			
8	5		Refused Takeoff - 35 kt x-wind	Off	On	Ŋ			
9	6 7		One Engine Out Takeoff	Off	On	٧			
10	8		One Engine Out Takeoff - 35 kt x-wind VMCG	Off	On O	-1			
	_		rom Low-Speed Flight	Off	On	٧			
11	9		Stall at Max Takeoff Power	Off.	0-	-1			
12	10		Stall at Idle Power	Off	On	Y			
13	11		Turning Stall at Idle Power	Off Off	On	Ŋ			-1
14	12		Turning Stall at Thrust for Level Flight	Off	On On	N/			√
15	13		Engine-out Stall	Off	On	J			
16	14		Engine-out Turning Stall	Off	On	Ÿ			
Block	2 -	Appro	oach, Landing, Go-Around						
17	1			Off	Ο	-1		1	
18	2	4020	Nominal Approach & Landing	Off	On	Ŋ		√	
19	3	7005	Nominal Approach & Landing (ASE on) Manual Throttle Landing	<b>On</b> Off	On On	1			
20	4		Decelerating Approach	Off	On On	٧			
21	5		Decelerating Approach/ Manual Throttles	Off	On				
22	6	4069	IAG (TIFS) Approach	Off	On		√	1	1
23	7	4093	Crosswind Landing - 25 kt (Procedure A		On	J	•	J	J
24	8	4093	Crosswind Landing - 25 kt (Procedure B	Off	On	Ì		J	J
25	9	4095	Crosswind Landing - 35 kt	Off	On	Ì		Ì	•
26	10		Go-Around, 50 ft	Off	On	·		Ì	
27	11	4086	Go-Around, 50 ft (ASE On)	On	On				
28	12		Go-Around, 30 ft (TS Off)	Off	On	V		V	
29	13		Go-Around, 30 ft (TS On)	Off	On	Ì		•	
30	14	4140	VFR Circling Approach	Off	On	•			
31	15	7050	Dynamic VMCL-2	Off	On	$\checkmark$			
Block	3 - 0	Opera	tion after Upsets						
32	1		Engine Unstart	Off	On	V			
33	2		Engine Unstart (ASE ON)	Off	On	Ž			
34	3	6050	Inadvertent Speed Increase, high speed	Off	On	Ž			
35	4	6060	Simulated 2-axis Gust Upset, high speed	Off	On	Ÿ			
36	5	7040	Dynamic VMCA	Off	On	Ÿ			
37	6	5070	Emergency Descent	Off	Off	V			
38	7	5060	Diving Pull-out	Off	Off	$\checkmark$			

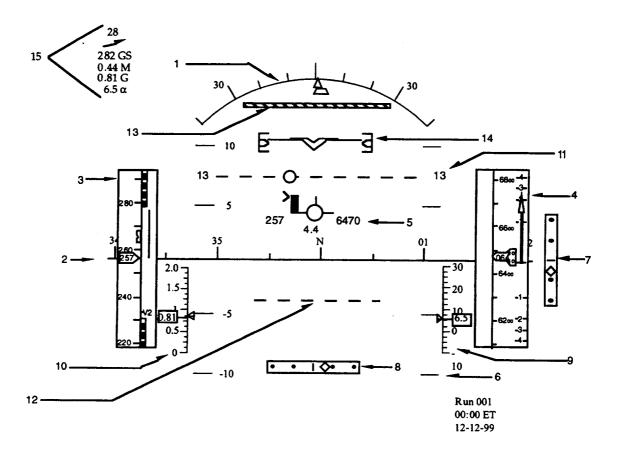
TABLE I. TASK LIST AND EXPERIMENT CROSS-REFERENCE (CONT'D)

Card   Seq.   Task   No.   No.   ID   Flight Card Name   Modes   Cueing LaRC.0 TIFS.1   Ames.1   Ames.2		-		Aero-		Used in Previous Experiment
Block 4 - Climb, Cruise, Descent   39	Card	Seq.	Task			-
39	No.	No.	ID Flight Card Name	Modes	Cueing	LaRC.0 TIFS.1 Ames.1 Ames.2
39				·		
40 2 3022 Climb Trans. to Level Flight - Supersonic Off On √ 41 3 3040 Level Flight Trans. to Climb Off On √ 42 4 3050 Profile Descent Off On √ 43 5 3060 Level Flight Trans. to Descent - Supersonic Off On √ 44 6 3062 Level Flight Trans. to Descent - Transonic Off On √ 45 7 3070 Transonic Accel Off On √ 46 8 3072 Supersonic Accel Off On √ 47 9 3074 Transonic Decel Off On √ 48 10 3076 Subsonic Decel Off On √ 49 11 3080 Heading Change - Transonic Climb Off On √ 50 12 3082 Heading Change - Initial Cruise Off On √ 51 13 3084 Heading Change - Final Cruise Off On √ 52 14 3086 Heading Change - Transonic Descent Off On √ 53 15 3088 Heading Change - Transonic Descent Off On √ 54 16 3030 Profile Climb Off On √ 55 17 27252 Elevator Hardover during takeoff Off On √ 56 1 7212 Elevator Hardover (TE down) during takeoff Off On √ 58 8 7253 Rudder Hardover during landing Off On √ 59 9 7254 Rudder Hardover during landing Off On √ 60 5 7291 Loss of 75% Roll Control during landing w/X- wind 61 6 7292 Flaperon Hardover during 2-axis upset Off On √ 62 3 7261 Elevator Hardover (TE up) during 2-axis upset Off On √ 63 17 7262 Flaperon Hardover during 2-axis upset Off On ← 64 10 7286 Go-around with Autoflap failure Off On ← 65 12 4110 Landing with Jammed Stabilizer Off On ←	Block	k 4 -	Climb, Cruise, Descent			
41 3 3040 Level Flight Trans. to Climb Off On √ 42 4 3050 Profile Descent Off On √ 43 5 3060 Level Flight Trans. to Descent - Supersonic Off On √ 44 6 3062 Level Flight Trans. to Descent - Transonic Off On √ 45 7 3070 Transonic Accel Off On √ 46 8 3072 Supersonic Accel Off On √ 47 9 3074 Transonic Decel Off On √ 48 10 3076 Subsonic Decel Off On √ 49 11 3080 Heading Change - Transonic Climb Off On √ 50 12 3082 Heading Change - Initial Cruise Off On √ 51 13 3084 Heading Change - Final Cruise Off On √ 52 14 3086 Heading Change - Transonic Descent Off On √ 53 15 3088 Heading Change - Transonic Descent Off On √ 54 16 3030 Profile Climb Off On √ 55 17 27212 Elevator Hardover (TE down) during takeoff Off On √ 57 2 7252 Elevator Hardover (TE down) during landing Off On √ 58 8 7253 Rudder Hardover during landing Off On √ 59 9 7254 Rudder Hardover during landing Off On √ 60 5 7291 Loss of 75% Roll Control during landing w/X- wind 61 6 7292 Flaperon Hardover (TE up) during 2-axis upset Off On √ 62 3 7261 Elevator Hardover (TE up) during 2-axis upset Off On ← 63 7 7262 Flaperon Hardover during landing Off On ← 64 10 7286 Go-around with Autoflap failure Off On ← 65 12 4110 Landing with Jammed Stabilizer Off On ← 65 12 4110 Landing with Jammed Stabilizer Off On ←	39	1	3020 Climb Trans. to Level Flight - Transonic	Off	On	$\sqrt{}$
42	40	2		Off	On	$\sqrt{}$
43 5 3060 Level Flight Trans. to Descent - Supersonic Off On √ 44 6 3062 Level Flight Trans. to Descent - Transonic Off On √ 45 7 3070 Transonic Accel Off On √ 46 8 3072 Supersonic Accel Off On √ 47 9 3074 Transonic Decel Off On √ 48 10 3076 Subsonic Decel Off On √ 49 11 3080 Heading Change - Transonic Climb Off On √ 50 12 3082 Heading Change - Initial Cruise Off On √ 51 13 3084 Heading Change - Final Cruise Off On √ 52 14 3086 Heading Change - Transonic Descent Off On √ 53 15 3088 Heading Change - Transonic Descent Off On √ 54 16 3030 Profile Climb Off On √ 55 1 7212 Elevator Hardover during takeoff Off On √ 56 1 7212 Elevator Hardover (TE down) during takeoff Off On 57 2 7252 Elevator Hardover (TE down) during landing Off On 58 8 7253 Rudder Hardover during landing Off On 59 9 7254 Rudder Hardover during landing Off On 57 291 Loss of 75% Roll Control during landing W/X-wind Off On 57 7262 Flaperon Hardover during landing VX-wind Off On 62 3 7261 Elevator Hardover during landing VX-wind Off On 63 7 7262 Flaperon Hardover during 2-axis upset Off On 64 10 7286 Go-around with Autoflap failure Off On 65 12 4110 Landing with Jammed Stabilizer Off On 67 On	41	3	3040 Level Flight Trans. to Climb		On	
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## Appendix A. HUD symbology

The Head Up Display (HUD) format shown below is referred to as the LaRC.1 HUD. The format shown below has all elements depicted; this "full clutter mode" is not used in any of the tasks of LaRC.1, but various elements can be enabled for specific tasks. This symbology set has been made to follow as closely as possible the symbology set discussed at an XVS symbology workshop at Langley in September 1996; but does not completely conform to the XVS symbology set due to resource limitations.

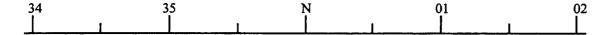
The various features of the HUD are indicated by their identification numbers (from 1 to 15) and are described in sequence below. Operation of the new HUD element logic is also discussed.



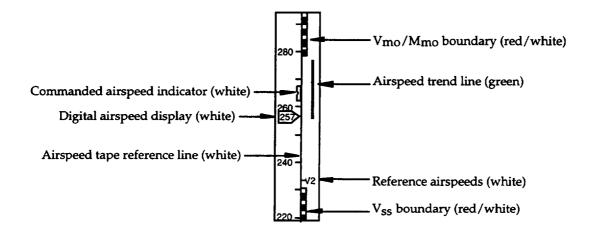
Bank angle scale with roll pointer and side-slip indicator. This section of the LaRC.1 HUD is specified to be the same as previously employed for the 1995 LaRC.0 assessment study. It should be noted that after initial evaluations during LaRC.0, the side-slip indicator (lower portion of roll pointer triangle) displays complementary filtered side-slip angle as the default for all tasks. The side-slip indicator will turn amber when it moves just past the edge of the roll pointer indicating a sideslip angle of 4 degrees.



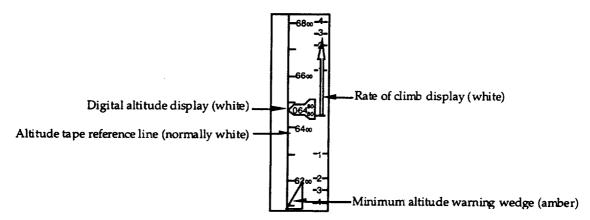
2 Heading scale/horizon line. This section of the LaRC.1 HUD is specified to be the same as previously employed for LaRC.0. Smaller tick-marks, without labels, are drawn at 5 degree increments.



Airspeed tape display. Item #3 is a totally new element for the NASA LaRC Ref.-H assessment project. It displays analog and digital un-filtered equivalent airspeed (EAS) as currently displayed only digitally on the 1995 LaRC.0 HUD. Several airspeed "bugs" are required for this system. Takeoff decision speed V<sub>1</sub>, rotation speed V<sub>r</sub>, takeoff safety speed V<sub>2</sub>, and V<sub>mo</sub>, M<sub>mo</sub>, maximum operating speed, are displayed. V<sub>mo</sub>/M<sub>mo</sub> and V<sub>min</sub> boundaries are indicated by red and white checkered areas on the right side of the airspeed tape reference line. Values V<sub>1</sub>, V<sub>r</sub>, V<sub>2</sub>, V<sub>mo</sub>, M<sub>mo</sub>, and V<sub>min</sub> are read from the maneuver initial condition (I.C.) files. V-speeds are displayed on the right side of airspeed tape reference line (white). Current commanded airspeed, either from the I.C. file or from the CDU, are displayed by the appropriate icon shown below on the left of the airspeed tape line (white). Digital equivalent airspeed is displayed in the high-lighted area to the nearest knot (white). The airspeed trend line (green) indicates the anticipated airspeed which will exist in 10 seconds. It emanates from the origin of the airspeed tape. The inertial acceleration parameter from the airspeed complementary filter system is used for this purpose. A 1.0 second time lag is applied to this variable to smooth its response. The open areas of the airspeed indicator are not shaded.

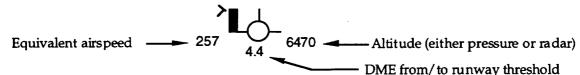


Altitude display tape. The altitude tape display is also a new HUD element. It's function is to provide detailed altitude information to the pilot. The digital altitude display (white) is different from the airspeed digital display in that the hundreds of feet digits scroll at a different rate than the tens of feet digits. For example, for altitudes between 6,500 and 6,600 the 065 would remain constant and the tens of feet digits would change. Note that the tens of feet digits are resolved in 20 foot increments. The color of the altitude tape reference line, tick marks, and labels are white unless the altitude is below the minimum altitude. When the altitude is below the minimum altitude, the altitude tick marks are amber. Minimum altitude is set to 200 feet AGL. The rate of climb display (white) indicates the analog rate of climb only when the rate of climb is between ±4,000 feet per minute (fpm). When the rate of climb is greater than ±4,000 fpm, the rate of climb will be displayed by three digits (white) at the top (or bottom) of the scale indicating rate of climb in hundreds of feet per minute. The scaling of this display is non-linear in that the distance from 0 to 1,000 fpm is twice that between 1,000 and 2,000 fpm, which is twice the distance between 2,000 and 3,000 fpm. The distance between 3,000 fpm and 4,000 fpm is the same as 2,000 fpm to 3,000 fpm. The minimum altitude wedge (amber) will become visible when the altitude reaches the minimum altitude (200 feet) with the base of the wedge touching the altitude scale line when the altitude reaches 0 ft. There is an option to switch between pressure altitude and radar (landing gear) altitude. When in radar altitude mode, an R (white) is displayed at the top and bottom of the altitude scale line. No indication is shown when not in radar altitude mode (i.e. a P is not displayed when not in radar mode in an attempt to reduce HUD clutter). The open areas of the altitude indicator are not shaded.

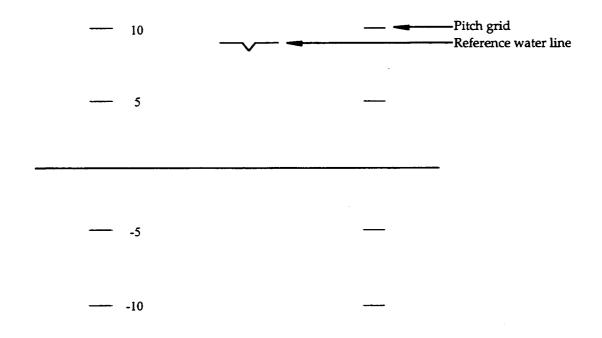


Velocity vector cluster. The velocity vector cluster (white) is similar to what was used in the 1995 LaRC.0 HUD, and includes the velocity vector symbol (an open circle with fins), option digital airspeed, altitude, and DME readouts, an airspeed error tape that grows above or below the left fin of the velocity vector symbol, and an acceleration indicator. The main difference is that the digital airspeed and altitude indicators of the 1995 LARC.0 HUD can be moved to the airspeed and altitude display tapes. DME distance from/to the runway threshold can also be displayed if desired. Other minor changes are the acceleration diamond is now a caret (>) and it is driven differently. The acceleration caret indications are now dependent on inertial acceleration which is computed in the airspeed complementary filter section. This computation employs the acceleration of the aircraft's C.G. resolved along the flight path. A 1 second lag is applied to this signal to improve its motion. In addition, the capability to automatically move the acceleration indicator from the velocity vector cluster up to the pitch reference waterline has been implemented. It will move up to the reference water line when the angle of attack is above 15 degrees and back to the velocity vector cluster when the angle of attack is below 14 degrees. This was done to enhance its use

during high angle of attack operations. Another feature of the acceleration arrow is that its zero position can be biased to permit its use while maintaining a non-zero acceleration, such as is desired for the entry phase of the recovery from limit flight tasks. During these tasks (maneuvers 5010, 5020, 5040, 5050, 7070, and 7080) a 1 kt/sec deceleration rate will result when the acceleration arrow is aligned with the left inlet of the velocity vector. A 1 kt/sec acceleration will move the acceleration arrow 1 degree on the HUD.

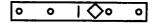


6. Pitch grid, reference water line, and heading scale. The pitch grid and reference water line (white) are changed for the 1996 LARC.0 HUD. The water line is replaced with a winged-V. Use of the 1995 LARC.0 HUD takeoff rotation brackets (magenta) and expanded reference water line (item #13) are included in the HUD option. The pitch grid is much wider than the 1995 LARC.0 HUD and has the center open. Only one set of pitch grid labels are indicated for this HUD option and are placed inside of the left side pitch grid tick marks. The Horizon line and heading scale is the same as the 1995 LARC.0 HUD. The tail-scrape bar (red/white), which is item #14, is also retained with this HUD option.



7,8. ILS glideslope and localizer displays. The ILS glideslope and localizer displays are colored white with a white moving diamond. When excessive deviation occurs, the white diamond changes to an amber flashing diamond. Excessive deviation is one dot. The glideslope display is placed just outside of the altitude display tape.

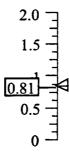




9) The analog/digital angle of attack display (white) is defined below. Digital angle of attack moves with the analog pointer on the scale. If the angle of attack is not displayed using this display, digital angle of attack is displayed in the upper left hand corner of the HUD.



10) The analog/digital "g" tape (white) display is defined below. Digital normal acceleration moves with the analog pointer on the scale. If the normal acceleration is not displayed using this display, digital normal acceleration is displayed in the upper left hand corner of the HUD.



The Takeoff Climb Guidance System is shown below. It consists of a labeled dashed line with a velocity vector guidance symbol (an open circle). The dashed line (magenta) is displayed when the pilot is commanded to fly a specific climb gradient (maneuvers 2010 and 2030). The labels of this line represent the climb gradient, in percent. When the velocity vector guidance system is operating in this mode, the velocity vector guidance symbol (also magenta) is constrained to travel across the dashed line and provides the pilot with steering information only to maintain the extended runway centerline. When the takeoff guidance system is in airspeed command mode (maneuvers 2011, 7035, and 7036) the dashed line is removed and the velocity vector guidance symbol provides both longitudinal and lateral information. Longitudinal guidance is a combination of airspeed error and inertial acceleration and is provided to assist the pilot to maintain the desired airspeed when operating in a fixed-thrust mode. The pilot attempts to place the velocity vector symbol on top of the velocity vector guidance symbol. The lateral guidance is the same regardless of which mode of the takeoff climb guidance system is selected.

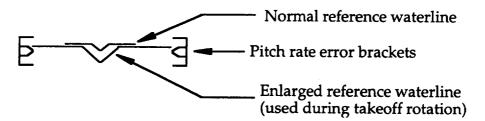


- 12) The depressed glideslope reference line is shown below (white). Its purpose is to provide the pilot with an indication of where to place the velocity vector to fly a flight path angle equal to the glideslope. It is horizontally slaved to the velocity vector.
- 13) The tail scrape bar (red and white) is shown below. It indicates what pitch attitude the aircraft would have to reach in order to scrape the tail on the ground.

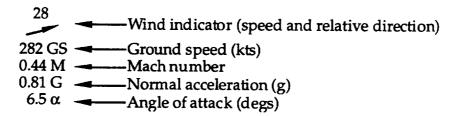
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14) Reference waterline (white) is shown below in two sizes. Most of the time the reference waterline is the smaller size which is indicated by the "normal reference waterline" label. During takeoff rotations, however, the reference waterline becomes much larger and is used in conjunction with the pitch rate error brackets to precisely control the aircraft's rotation performance. The pitch rate error brackets are approximately 2 HUD degrees high. A pitch rate error of ±0.5 deg/sec will displace the pitch rate error bracket one half the height of the inner pointer with respect to the refer-

ence waterline. A pitch rate error of  $\pm 1.0$  deg/sec will displace the pitch rate error bracket one half of its total height with respect to the reference waterline.



15) The digital information which can be displayed in the upper left hand corner of the HUD is shown below. When angle of attack and normal acceleration are being displayed using the analog/digital tape displays, those parameters are removed from this element.



HUD display control: Display of all of the HUD items listed below are controlled through the I.C. files for each of the assessment tasks. Each task has several HUD options that can be viewed by striking the HUD declutter button on the simulator instrument panel. In general, three HUD options are available along with varying levels of declutter. Repeatedly striking the declutter button will eventually remove all HUD symbology. Additionally, HUD mode changes, such as encountered during the go-around maneuver, will induce an automatic HUD change when the pilot strikes the TOGA button.

## Appendix B. Flight cards

The following pages represent the flight cards used in the Ref. H Assessment test.

## Flight Card Nomenclature

AGL Above Ground Level, ft
ALT Altitude
AOA Angle of attack, degrees

A/T Autothrottle

CDU Cockpit Display Unit

C.G. Center of gravity, % of mean aerodynamic chord

CHR Cooper-Harper pilot rating
Config Aircraft configuration

Distance Measuring Equipment (shorthand for distance from runway

threshold)

**EPR** Exhaust Pressure Ratio (shorthand for throttle position)

F/D Flight Director FPM, fpm Feet per minute GEAR Landing gear position

G/S Glide slope (part of the instrument landing system)

GW Gross weight HUD Head-up display

ILS Instrument Landing System
KEAS Equivalent airspeed, knots
LEF Leading edge flaps, degrees

LOC Localizer (part of the instrument landing system)

M Mach Number

Mass case 13 - maximum taxi weight at forward C.G.

MCT Maximum continuous thrust
MFC Final Cruise mass condition
MIC Initial Cruise mass condition
Mmo Maximum Operating Mach Number

MTE Mission Task Element

MTO Maximum Takeoff power setting

N/A Not applicable OM Outer Marker

**PFD** Primary Flight Display

**PSCAS** Pitch Stability and Control Augmentation System

PIO Pilot-Induced Oscillation R/C Rate of climb, ft/min

**RSCAS** Roll Stability and Control Augmentation System

**TEF** Trailing edge flaps, degrees

TO/GA Takeoff/Go-Around

Trim Indicates this parameter should be set to the value required to achieve

trimmed (unaccelerated) initial conditions.

V1 Takeoff Decision Speed V2 Takeoff Safety Speed Vapp Approach Speed

Vapp1 Approach Speed, first approach segment

Vapp2 Approach Speed, second approach segment

VFR Visual Flight Rules
Vg/a Go-Around Speed
VHD Velocity/Height Display

VLO, Vlo Lift-off Speed

Vmin Minimum Operating Speed
Vmo Maximum Operating Speed
Vmca Minimum Control Speed, air
Vmcg Minimum Control Speed, ground

Vmcl-2 Minimum Control Speed, landing, two engines out

Vr Takeoff Rotation Speed

Vref Reference Speed V/S Vertical speed

Date:

Long CHR |Lat / Dir CHR

Y Z

Evaluation Segment: Runway Centerline Tracking - RTO Start Evaluation: Stopped on Runway End Evaluation: Wheel stop

Runs:

Pilot:

Evaluation Basis: The pilot is to evaluate the ease of tracking the runway centerline with rudder pedals alone as the aircraft accelerates during the takeoff roll and the deceleration during the RTO.

Refused Takeoff

Failures	lures	ax payload		ition	enterline		
	.   0. No Failures	oading:   3. M13 - Max Taxi Weight @ fwd C.G., full aft fusclage fuel, partial wing fuel, max payload.		Initial Position	End of Rwy, on centerline		hnormals/Exceptions:
Weather State	1. Light Turb	ll aft fusclage t	Rwy	Surface	Dry,	grooved	NORMAL A
MTE	<b>Fakeoff</b>	® fwd C.G., fu	Ceiling/	Visibility	Unlimited/	Unlimited	1701 PSCAS NO
Z	5. Rejected	Taxi Weight (	Approach	Category	0		1701
ight Phase	ſſ	3. M13 - Max	Turb/	Gusts	Light/	None	Field
Fligh	2A. Takeof	Loading:	Head/X	Wind, kt	0 KV	0 <b>K</b> t	ALT

0. No Failures	iial wing fuel, max payload		Initial Position	End of Rwy, on centerline	_	Abnormals/Exceptions:	•				
1. Light Turb.	ill aft fuselage fuel, partial wing fuel, i	Rwy	Surface	Dry,	grooved		VORMAL None		NO	OFF	H Cyc 3
Takeoff	@ fwd C.G., fu	Ceiling/	Visibility	Unlimited/	Unlimited	Γ	RSCAS NO	A/T	HUD	F/D	Config Ref H Cyc 3
5. Rejected Takeoff	Taxi Weight @ f	Approach	Category	6		0/1 1/0	Vr 186	007 CO	V2 202	•	
J	oading:   3. M13 - Max Taxi	Turb/	Gusts	Light/	None	Field	<del>-</del>	GW 649,914 V	48.1		30/10 Vmin
2A. Takeof	Loading:	Head/X	Wind, kt	0 KV	0 <b>K</b> t	ALT	KEAS/M	ĕ B B	င်.	GEAR	LEF/TEF

<b>Q</b>	±27 ±10 ±27				
Target					
Performance Standards	Runway Centerline Deviation (ft)				
	None.   ALT Field   V1   170   PSCAS   NORMAL   Abnormals/Exceptions:	Procedure—Test Engineer / Pilot Not Flying (PNF):  1. Confirm initial conditions.  2. Make airspeed callout at 100 knots.  3. Immediately before reaching V1, call "Engine # Failed, Abort".			

3-Dec-96 LJG

Date:

Refused Takeoff

1052

Evaluation Seement: Dunism Centerline Tending DIO	Start Evaluation	End Evaluation: Wheel etch	-	Evaluation Backe: The pilot is to evaluate the ease of tracking the	as the aircraft accelerates during the takeoff roll and the development	
ate Fallures	C	ti Weight @ fwd C.G., full aft fuselage fuel, partial wing fuel, max payload		Initial Position	End of Rwy, on centerline	
Weather State	33. 35 Kt Crosswind	l aft fusciage fuel,	Rwy	Surface	Dry,	prooved
TTE	Rejected Takeoff	@ fwd C.G., ful	proach Ceiling/	Category   Visibility	Unlimited/	Unlimited
	5. Rejected	: Taxi Weight	Approach	Category	0	
nt Phase	JJ.	3. MI3 - Max	Turb/	Gusts	Light	None
Fligi	2A. Taked	Loading:	Head/X	Wind, kt	0 KV	35 Kt

Initial Po	End of Rwy, on	Abnormals/Exceptions None.	
Surface	Dry, grooved		Ref H Cyc 3
Visibility	Unlimited/ Unlimited	170 PSCAS NO 186 RSCAS NO 200 A/T 202 HUD 212 F/D	Config Ref h
Category	0	V1 170 Vr 186 VLO 200 V2 202 V2+10 212	
Gusts	Light/ None	Field 0 49,914 48.1 DOWN V	30/10
Wind, kt	0 KV 35 Kt	ALT KEAS/M GW 6 C.G. GEAR	LEFTEF

- Procedure—Evaluation Pilot (PF):

  1. Set brakes.

  2. Advance throttles to takeoff EPR.

  3. Release the brakes and maintain centerline during ground roll. PNF will make airspeed call-outs and monitor engine performance.

  4. When PNF calls "Abort" immediately retard throttles to idle and apply maximum braking. Maintain runway centerline.

  5. Terminate the maneuver when the aircraft is stopped.

Procedure-Test Engineer / Pilot Not Flying (PNF):
1. Confirm initial conditions.

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	· <u>₹</u>
	<u>.इ</u>
	<u>"</u>
	핗
Ş	ŭ
nots.	÷.
중	>
8	80
8	hing
흔	aching
it at 10	reaching
lout at 10	re reaching
lout at 10	fore reaching
it at 10	before reaching
lout at 10	ly before reaching
lout at 10	itely before reaching
lout at 10	diately before reaching
lout at 10	nediately before reaching
lout at 10	nmediately before reaching
lout at 10	Immediately before reaching
lout at 10	<ol> <li>Immediately before reaching</li> </ol>
lout at 10	<ol><li>Immediately before reaching</li></ol>

CVariation.	Wheel stop		N/A	
Evaluation Basis: 1 as the aircraft acceler	Evaluation Basis: The pilot is to evaluate the ease of tracking the runway centerline with rudder pedals alone as the aircraft accelerates during the takeoff roll and the deceleration during the RTO.	cking the runway coeleration during the	enterline with ruch he RTO.	der pedals alone
Perfe	Performance Standards	Target	Desired	Adequate
Runway Centerline Deviation (	Deviation (ft)	0	±10	±27

Long CHR Lat / Dir CHR

Runs:

Pilot:

|--|

Runs:

2010

Standard Acoustic Takeoff

Fligh	ht Phase	M	MTE	Weather State	State	Failures
2A. Takeof	Įį	100. Standard Acoustic Takeoff	•	1. Light Turb.		0. No Failures
Loading:	3. M13 - Max	Taxi Weight @	ø fwd C.G., fu	ll aft fuselage ft	iel, partial wing	.oading: [3. M13 - Max Taxi Weight @ fwd C.G., full aft fusclage fuel, partial wing fuel, max payload
Head/X	Turb/	Approach	Ceiling/	Rwy		
wind, Ki	Gusts	Category	VISIDILITY	Surface		Initial Position
0 KV	Light	0	Unlimited/	Dry,	End of Ru	End of Runway on Centerline
0 K	None		Unlimited	grooved		•

Abnormals/Exception	None				
NORMAL		PFO FFO			Ref H Cyc 3
PSCAS	RSCAS	Υ	HUD	F/D	Config
170	186	205	202	212	181
IA	Λ	N <sub>L</sub> O	٧z	V2+10	Vmin
Field	0	649,914		DOWN	Auto
ALT	KEAS/M	ĕ	ن. ن.ن	GEAR	LEF/TEF

] ii

Evaluation Se	gment:	Evaluation Segment: Takcoff Roll, Rotation & Initial Climb Out - Acoustic	Climb Out -	Long CHR	Long CHR Lat / Dir CHR
Start Evaluation: End Evaluation:		Stopped on Runway Just prior to EPR cutback			
Evaluation Basi strike), liftoff, an	ls: The pi nd capture	Evaluation Basis: The pilot is to evaluate the ability to track runway centerline, rotate promptly (without tail strike), liftoff, and capture the target climb speed. No PIOs or geometry strikes are allowed.	k runway centel or geometry stril	rline, rotate promp kes are allowed.	otly (without tail
Pc	erforma	Performance Standards	Target	Desired	Adequate
Rotation pitch attitude (deg)	itude (de)	g)	01	10∓0.5	1401
Deviation from climb speed (kt)	limb spee	3d (kt)	0	∓\$	01∓
Bank Angle Control (deg)	trol (deg)		0	£Ş	710
Runway Heading Deviation (deg)	3 Deviation	on (deg)	0	±2	<del>1</del> 4
Load Factor (g)			1.0±0.2	1.0±0.2	1.0±0.3
Climbout Flight Path Angle (deg)	Path Ang	le (deg)	8	8±0.5	8±1.0
Evaluation Segment: EPR Cutback	gment:	EPR Cutback		Long CHR	Long CHR   Lat / Dir CHR
Start Evaluation: End Evaluation:		Initiation of EPR cutback Stabilized at V2+10 kt after cutback	ck		
			•		
Evaluation Basi Also evaluated is	is: The pi	Evaluation Basis: The pilot is to evaluate the ability to maintain the climb airspeed and desired flight path Also evaluated is the ability to maintain runway heading with minimal roll angle. No PIOs are allowed	ntain the climb	airspeed and desir	ed flight path
		O			

						, .	1		
Lat / Dir CHR	illowed.  Adequate ±10	±10 ±4 1.0±0.3 2.5±1.0							
Long CHR	igle. No PIOs are a  Desired	±2 1.0±0.2 2.5±0.5							
tback	vith minimal roll ar  Target  0	0 1.0±0.2 2.5							
Evaluation Segment: EPR Cutback Start Evaluation: Stabilized at V2+10 kt after cutback Evaluation: Evaluation Basis: The pilot is to evaluate the ability to maintain the climb airspeed and desired flight path	Also evaluated is the ability to maintain runway heading with minimal roll angle. No PIOs are allowed  Performance Standards Target Desired Ade Deviation from Climb Airspeed (kt)  Output  Deviation from Climb Airspeed (kt)  Output  Deviation from Climb Airspeed (kt)	viation (deg.) Angle (deg.)							
Evaluation Segment: EPR Cutback Start Evaluation: Initiation of E End Evaluation: Stabilized at V Evaluation Basis: The pilot is to evaluation	Also evaluated is the ability to main  Performance Star  Deviation from Climb Aispeed (ki)	Bank Angre Conton (deg) Runway Heading Deviation (deg) Load Factor (g) Climbout Flight Path Angle (deg)		_					
•		9. Terminate maneuver at 8.0 DME.  Sprocedure—Test Engineer / Pilot Not Flying (PNF):  1. Confirm takeoff flap and reference speed bugs (Vc=V2+10=212 kts) and initial climb gradient (8 deg/14%)	are property set. High-light the desired initial climb gradient (grad I) and prepare the secondary climb gradient to be used at cuback.  2. Make airspect call-outs at 100 knots, VI, and Vr.  3. Move gear handle to gear-up position, when requested by PF.  4. At 2.8 DME, call "cuback," change the commanded flight path angle to the secondary climb gradient (2.5 deg/4.4%) and engage autothrottles.						

# Standard Acoustic Takeoff - atternate procedure

2011

Fileh	Flight Phase	2	MTR	Westher State	State	Pailman
					71	CO IDILLY
2A. Takeo	l l	100. Standar	d Acoustic	L. Light Turh		O. No Estlures
		Takeoff	Takeoff			
Loading:	3. MI3 - Max	Taxi Weight &	a fwd C G fu	aft fuscione for	nartial wino	osding:   3. Mis. Max Taxi Weiphi @ fwd C.G. full aff fuselsos fuel naries wing fuel may nauload
			1010 0111		direction wing	toch liter payton
Head/X	Turb/	Approach	Ceiling/	Kwv		
Wind, kt	Gusts		Visibility	Surface	Initi	Initial Position
0 KV	Light	0	Unlimited	Dry.	End of Run	End of Runway on Centerline
0 Kr	None		Unlimited	grooved		

	Abnormals/Exceptions	_				
i	ı				TO spd	181 Config Ref H Cyc 3
	PSCAS	RSCAS	Α⁄Τ	HUD	2 F/D	Config
	170	186	202	202	212	181
	VI	٧.	VLO	<b>V2</b>	V2+10	Vmin
	Field	0	649,914	48.1	N N O N	30/10
	ALT	KEAS/M	GW €	<u>ပ</u> ဲ	GEAR	LEF/TEF

Note: This maneuver to be performed with manual thrust and flaps.

## Procedure-Evaluation Pilot (PF):

- Set brakes.
  Advance throities to takeoff EPR.
  Release the brakes and maintain centerline during ground roll. PNF will make airspeed call-outs and
  - monitor engine performance.
- At rotation speed (VP), initiate rotation to follow rotation rate pitch guidance indicators. Utilize HUD guidance to preclude tail-strikes.
   At positive climb-rate, call "gear up". Follow velocity vector guidance symbol to intercept and maintain speed and extended runway centerline.
   When established at V2+10, PNF takes control of the throttles.
   Maintain target climb airspeed and runway heading throughout cutback maneuver.
   B. Terminate maneuver at 8.0 DME to record data for acoustic calculations.
- Procedure-Test Engineer / Pilot Not Flying (PNF):

  - Confirm initial conditions.

    Make airspeed call-outs at 100 knots, VI, and Vr.
- Move gear handle to gear-up position, when requested by PF.

  Monitor gear retraction and automatic device retraction.
  Make distance call-outs at 2.6 and 2.7 DME. At 28 DME, call "cutback" and manually retard throttles to cutback EPR (56%) over an approximately 7 second interval.

  Maintain cutback condition until 8.0 DME for acoustic calculations.

Date:

Evaluation Segment: Takcoff Roll, Rotation & Initial Climb Out Just prior to EPR cutback Stopped on Runway Start Evaluation: End Evaluation:

Long CHR | Lat / Dir CHR

Evaluation Basis: The pilot is to evaluate the ease of tracking the runway centerline with rudder pedals alone as the aircraft accelerates during the takeoff roll. The pilot is to evaluate the control of the rotation and capability to track the pitch rate guidance indicators, and the ability to follow velocity-vector guidance once airborne. No PIO is allowed. No geometry strikes are allowed.

Performance Standards	Target	Desired	Adequate
Runway Centerline Deviation, on ground (ft)	0	01 <b>Ŧ</b>	±27
Rotation Pitch Rate Contol, on ground (deg)	generated	1	<=! bracket 90%
		90% of time	of time (±1.2
Longitudinal velocity vector control, airborne (de)	generated	(±0.0 degs)	C+2 V-vector
	)	height 90% of	height 90% of
		time	time
Lateral velocity vector control, airborne (deg)	generated	V-vector	-2 V-vector
		width 90% of	width 90% of
		time	time
Deviation from climb speed, after Vc intercept (kt)	0	±5	01∓
Bank Angle Control, airborne (deg)	0	£\$	01∓
Runway Heading Deviation, airborne (deg)	0	±2	±4

Evaluation Segment: EPR Cutback - PLR	EPR Cutback - PLR	Long CHR   Lat / Dir CHR	Dir CHR
ë	Initiation of second EPR cutback		
End Evaluation:	8.0 DME		-

Evaluation Basis: The pilot is to evaluate the ability to maintain the climb airspeed. Also evaluated is the ability to maintain runway heading with minimal roll angle. No PIO is allowed.

Performance Standards	Target	Desired	Adequate
Longitudinal velocity vector control (deg)	generated	<±1 V-vector	<±2 V-vector
	•	height 90% of	height 90% of
		time	time
Lateral velocity vector control (deg)	generated	<±1 V-vector	<±2 V-vector
		width 90% of	width 90% of
		time	time
Deviation from Climb Airspeed (kt)	0	±5	01∓
Bank Angle Control (deg)	0	£\$	01∓
Runway Heading Deviation (deg)	٥	±2	∓4

Runs:

Pilot:

Acoustic (Prog Lapse Rate) takeoff

Filgi	ıt Phase	E .	MTE	Weather State	State	Failures
2A. Takeo	ĮĮ.	102. Program Rate Takeoff	mmed Lapse f	12. Moderate Turb. w/Gusts		0. No Failures
Loading:	3. M13 - Max	Taxi Weight	ø fwd C.G., ful	l aft fuselage f	uel, partial w	oading:   3. M13 - Max Taxi Weight @ fwd C.G., full aft fuselage fuel, partial wing fuel, max payload
Head/X	Turb/	Approach	Celling/	Rwy		
Wind, kt	Gusts	Category	Visibility	Surface	Ĭ	Initial Position
0 KV	Moderate/	0	Unlimited	Dry,	e pua	End of Rwy, on centerline
0 Kt	None		Unlimited	grooved		

Abnorm		speed		Luioaca.		
NORMAL	Š			TO grad.	шоф	Ref H Cyc 3
<b>PSCAS</b>	RSCAS	A/T	HOD	F/D		181 Config
<u></u>	186	502	202	250		181
5	'n	ALO	۷2	Vclimb		Vmin
Field	0	649,914	48.1	N 00		Auto
ALT	KEAS/M	ٍٰۏ	<u>ပ</u>	GEAR		LEF/TEF

EPR (T0): Max; First cutback VCUT): 187; Delta time first: 7 seconds;First cutback thrust 1): 75% nals/Exceptions:

Procedure-Evaluation Pilot (PF):

Engage autothroutie, verify initial and secondary climb gradients (grad1, grad2), and confirm proper EPR (as set by the autothroutie system) and flap position (as set by the autoflap system).
 Release the brakes and maintain centerline during ground roll.
 A rotation speed (Vr), initiate rotation to follow rotation rate pitch guidance indicators. Utilize HUD guidance to preclude tail-strikes.
 A positive climb-rate, call "gear-up".
 Maneuver the aircraft to follow velocity vector guidance to maintain the extended runway centerline and desired climb gradient.
 An approximately 3.0 DME and 250 kts, intercept and maintain secondary target climb gradient (if different than the initial climb gradient).

Procedure—Test Engineer / Pilot Not Flying (PNF):
Confirm initial conditions.
Make airspeed call-outs at 100 knots, VI, and Vr.
Raise landing gear upon PF call.
Monitor progress of first automatic thrust reduction to first cutback thrust level (TI).
Once first thrust reduction is complete call out "TI thrust".
At approximately 3.0 DME and 250 knots, monitor the autothrottle system transition to airspeed hold mode as it completes the second thrust cutback.
Continue the maneuver to at least 8.0 DME to record sufficient data for acoustic calculations.

	PLR	- 100 011110		
Start Evaluation: End Evaluation:	Stopped on Runway Just prior to second EPR cutback	ck		
Evaluation Basis: The pilot is to evaluate the east the aircraft accelerates during the takeoff roll. It to track the pitch rate guidance indicators, and the PIO is allowed. No geometry strikes are allowed.	Evaluation Basis: The pilot is to evaluate the ease of tracking the runway centerline with rudder pedals alone as the aircraft accelerates during the takeoff roll. The pilot is to evaluate the control of the rotation and capability to track the pitch rate guidance indicators, and the ability to follow velocity-vector guidance once airborne. No PIO is allowed. No geometry strikes are allowed.	cking the runway is to evaluate the co follow velocity-	centerline with ruc control of the rotati vector guidance on	ider pedals alone on and capability ice airborne. No
Perform	Performance Standards	Target	Desired	Adequate
Runway Centerline Deviation, on ground (ft)	ation, on ground (ft)	0	01∓	£27
Rotation Pitch Rate Contol, on ground (deg)	ol, on ground (deg)	generated	<±0.5 bracket	di bracket 90%
			90% of time	of time (±1.2
			(±0.6 deg/s)	deg/s)
Longitudinal velocity vector control, airborne (de)	tor control, airborne (de)	generated	V-vector	<=2 V-vector
			height 90% of	height 90% of
			time	time
Lateral velocity vector control, airborne (deg)	ntrol, airborne (deg)	generated	V-vector	<±2 V-vector
	1		width 90% of	width 90% of
			time	time
Bank Angle Control, airborne (deg)	ome (deg)	0	Ş∓	01∓
Runway Heading Deviation, airborne (deg)	ion, airborne (deg)	0	<del>1</del> 5	±4

Svaluation Segment: EPR Cutback - PLR	EPR Cutback - PLR	Long CHR Lat / Dir CHR	t / Dir CHR
tart Evaluation: and Evaluation:	Initiation of second EPR cutback 8.0 DME		
valuation Basis: The n	valuation Basis: The pilot is to evaluate the ability to maintain the climb aircreed. Also evaluated is the	irspeed. Also exalinat	ed is the

ability to maintain runway heading with minimal roll angle. No PIO is allowed.

Performance Standards	Target	Desired	Adequate
Longitudinal velocity vector control (deg)	generated	<=! V-vector	<±2 V-vector
		time	time
Lateral velocity vector control (deg)	generated	-tl V-vector	<±2 V-vector
		width 90% of	width 90% of
		time	time
Deviation from Climb Airspeed (kt)	0	S∓ .	01∓
Bank Angle Control (deg)	0	Ş∓	01∓
Runway Heading Deviation (deg)	0	±2	<del>1</del> 4

2030
-4
_
2030

13-Dec-96 EBJ

Date:

Long CHR Lat / Dir CHR

Evaluation Segment: Transition to Level Flight (Sub/Transonic)

Pilot:

Constant-speed Climb or Descent Constant-speed Level Flight

Start Evaluation: End Evaluation:

Runs:

Climb Trans. to Level Flight - Transonic

3020

FIIgl	it Phase	M	TTE	Weather State	State	Failures
5A. Transonic (	nic Climb	201. Transiti Flight	01. Transition to Level	1. Light Turb.		0. No Failures
Loading:	13. M13 - Max Taxi Weight @ fwd C.G., full aft fuselage fi	Taxi Weight 6	Fwd C.G., fu	ll aft fusclage fi	iel, partial wi	fuel, partial wing fuel, max payload
Head/X		Approach	Celling/			
Wind, kt	٦	Category	>	Surface	-	Initial Position
0 Kv	Light/	0	Unlimited/	Dry,		N/A
0 Kt	None		Unlimited	grooved		

Loading:   3. M13 - Max Taxi Weight @ fwd C.G., full aft fuselage fuel, partial wing fuel, max payload	Initial Position	N/A	Abnormals/Exceptions: Thrust Multiplier set to 1.09
l aft fusclage	Rwy Surface	Dry, grooved	
P fwd C.G., ful	Celling/ Visibility	Unlimited/ Unlimited	PSCAS NORMAL RSCAS NORMAL AT OFF HUD OFF F/D OFF
: Taxi Weight (	Approach Category	0	EPR 100% PSCAS R/C Trim RSCAS A/T HUD F/D Confis R
3. MI3 - Max	Turb/ Gusts	Light/ None	26,000 350 649,914 48.1 UP
Loading:	Head/X Wind, kt	0 Kv 0 Kt	KEAS/M GW C.G. GEAR LEF/TEF

Procedure-Evaluation Pilot (PF):

1. PF establishes constant-heading steady-climb at the noted conditions.

2. Approaching a cardinal altitude (e.g. FL 270), rapidly pitch over and reduce power to attain steady level flight at the specified altitude while maintaining airspeed.

Procedure-Test Engineer / Pilot Not Flying (PNF): 1. Confirm initial conditions.

be smooth and continuous.			
Performance Standards	Target	Desired	Adequate
Maximum Overshoot of Target Altitude	0	₹100	±150
Deviation in Airspeed/Mach (KEAS)	0	±5/0.01M	±10/0.02M
Deviation in Heading (deg)	0	±2	Ŧ
Deviation in Bank Angle (deg)	0	112	¥

	,	***************************************		

10-Jan-97 EBJ

Date:

Pllot:

Runs:

Adequate ±300 ±10/0.02M ±5 ±5

Desired ±200 ±50.01M ±2 ±2

Target

Performance Standards

Maximum Overshoot of Target Altitude Deviation in Airspeed/Mach (KEAS) Deviation in Heading (deg) Deviation in Bank Angle (deg)

Climb Trans. to Level Flight - Supersonic 3022

ir CHR			between	
Lat/D	_		e coupling	
Long CHR [Lat / Dir CHR			te. Evaluate	on cuange.
T	<u> </u>	_	in climb ra	omignian.
Evaluation Segment: Transition to Level Flight (Supersonic)	Constant-speed Climb or Descent	Constant speed pover ingin	Evaluation Basis: Check ability to maintain airspeed during change in climb rate. Evaluate coupling between bistoped and flight math. Evaluate handling musting change of configuration change. The templifies that	inous.
Evaluation Segmen	Start Evaluation: End Evaluation:		Evaluation Basis: Chairman	be smooth and continuous.
П		П		
Failures	0. No Failures		Initial Position	N/A
State				
Weather	1. Light Turb.		Rwy	Dry, grooved
ire	ransition to Level	ition	Ceiling/ Visibility	Unlimited/ Unlimited
M	201. Transit Flight	al Cruise condi	Approach Category	0
ase	Climb	MIC - Initis	Turb/ Gusts	ight/ Vone
	onic (	5.		<b> </b>

Wind, kt   Gusts   Category Visibility   Surface	Initial Position	N/A	Abnormals/Exceptions: Thrust Multiplicr set to 1.09	
EPR 100% PSCAS NOR A/T HUD FID FID FID FOR STATE A/T A/T CONFIGURE FOR STATE A/T	ce	p	₹ E	J
EPR 100% PSCAS R/C Trim RSCAS A/T HUD F/D Config R		Dry, groove	ORMAL ORF OFF OFF	H Cyc 3
EPR 100% I	ij	ted/		Ref
EPR EPR		Unlimit Unlimi	PSCAS RSCAS A/T HUD F/D	Config
F"	tegory	0	100% Trim	
Wind, kt Gusts   OKV   Light   OKV   None   ALT 50,000   CK SSM   450   CK SSM   C	చ		EPR R/C	
Wind, kt 0 KV 0 Kt ALT KEAS/M GW C.G. GEAR LEF/TEF		Light/ None	50,000 450 614,864 52.5 UP	Auto
	Wind, kt	0 Kt/ 0 Kt	KEAS/M GW G.G.	LEF/TEF

Procedu 1. PF es 2. Appr flight

Procedu 1. Confi

							3022
						-	
		_					
	educe power to attain steady level						
F): steady-climb at the noted conditions.	pproaching a cardinal altitude (e.g. FL 510), rapidly pitch over and reduce power to attain steady level ght at the specified altitude while maintaining airspeed.  edure—Test Engineer / Pilot Not Flying (PNF): onfirm initial conditions.						
cdure-Evaluation Pilot (PF)	pproaching a cardinal altitude (e.g. FL 510), rapidly pitch ght at the specified altitude while maintaining airspeed. edure—Test Engineer / Pilot Not Flying (PNF): onfirm initial conditions.						22

Runs:

Pilot:

Profile Climb

Initial Position End of Rwy, on centerline Weather State Rwy Surface Dry, grooved Celling/ Visibility Unlimited Unlimited tht & CG varies Approach Category Loading: X. Misc. - Weight
Head X. Turb/ Api
Wind, kt Gusts Ca.
0 KV None/

Abnormals/Exceptions:	12		_		
NORMAL	NORMAL	OFF	Ö	Ö	Ref H Cyc 3
PSCAS	RSCAS	AT	HUD	F/D	Config
154	98	8	194	504	155
IA	Ņ	VLO	V2	V2+10	Vmin
Field	0				Auto
ALT	KEAS/M	<b>₹</b>	ပ <u>်</u>	GEAR	LEF/TEF

Procedure-Evaluation Pilot (PF):

- Set brakes.
   Advance throttles to takeoff EPR.
   Advance throttles to takeoff EPR.
   Release the barkes and maintain centerline during ground roll. PNF will make airspeed call-outs, and monitor engine performance.
   At rotation speed (Vr), initiate rotation to the lift-off pitch attitude. After liftoff, continue rotation until the target climb airspeed and pitch attitude are captured.
   At rotation speed (Vr), instance of a spear-up.
   At positive climb-rate, call "gear-up.
   Follow flight director and altitude-velocity display guidance until 2.3 M is reached.

- Procedure—Test Engineer / Pilot Not Flying (PNF):
  1. Confirm initial conditions.
  2. Make airspeed callouts at 100 knots, VI, and Vr.
  3. Move gear handle to gear-up position, when requested by PF.

End Evaluation:	2.3M			
Evaluation Basis: The pilot is lesired airspeed and attitude.	<b>Evaluation Basis:</b> The pilot is to check the handling qualities in profile climb. Evaluate ease of following desired airspeed and attitude.	lities in profile cli	mb. Evaluate ease	e of following
Perform	Performance Standards	Target	Desired	Adequate
ank Angle Control (deg	(	0	£\$	<u>0</u>
eviation in heading (deg	3)	0	±2	#\$

|--|--|--|--|--|--|--|--|

13-Dec-96 EBJ

Date:

Runs:

Pilot:

Adequate

Desired

Target

Performance Standards

#100 #100 #100 #100

Deviation in Bank Angle (deg)
Deviation in Target Rate of Climb (fpm)
Deviation in Heading (deg)
Overshoov/Undershoot in Airspeed (KEAS)

Level Flight Trans. to Climb

3040

Long CHR   Lat / Dir				Check for undesirable airspeed		
Evaluation Segment: Airspeed Change in Climb/Descent (Subsonic)   Long CHR   Lat / Dir CHR	Steady Elight of Initial Constant Airman	Steady Flight at New Constant Airspeed		Evaluation Basis: Check ability to initiate climb during normal operations. Check for undesirable airsneed		
Evaluation Segment:	Start Evaluation:	End Evaluation:		Evaluation Basis: Chec	coupling.	
		-				
S		paq				
r State Failures	. 0. No Failures	uel, partial wing fuel, max payload		Initial Position	V/N	
Weather State Failure	1. Light Turb. 0. No Failures	ll aft fuselage fuel, partial wing fuel, max paylo	Rwy	Surface Initial Position	Dry, N/A	grooved
TE Weather State Fallure	ion to Climb 1. Light Turb. 0. No Failures	Ø fwd C.G., full aft fuselage fuel, partial wing fuel, max paylo	Ceiling/ Rwy	Visibility Surface Initial Position	Undimited Dry, WA	Unlimited grooved
MTE Weather State Failure	211. Transition to Climb 1. Light Turb. 0. No Failures	Taxi Weight @ fwd C.G., full aft fuselage fuel, partial wing fuel, max paylo	Approach Ceiling/ Rwy	Category Visibility Surface Initial Position	0 Unlimited Dry, NA	Unlimited grooved
it Phase MTE Weather State Fallure	nic Cruise 211. Transition to Climb 1. Light Turb. 0. No Failures	3. M13 - Max Taxi Weight @ fwd C.G., full aft fuselage fuel, partial wing fuel, max paylo	Turb/ Approach Ceiling/ Rwy	Gusts   Category   Visibility   Surface   Initial Position	Light 0 Unlimited Dry, WA	None Unlimited grooved

Initial Position N/A Abnormals/Exceptions:	S S S S S S S S S S S S S S S S S S S	Trim PSCAS NORMAL  ORSCAS NORMAL  ORSCAS NORMAL  A/T  HUD  OFF  HUD  OFF  Config Ref H Cv OFF	Category 0 0 EPR Trim R/C 0	Gusts Light None 250 250 649,914 48.1 UP	Wind, kt 0 KU 0 KI 0 KI CEAS/M C.G. C.G. CEF/TEF
Loading: 3. M13 - Max Taxi Weight @ fwd C.G., full aft fuselage fuel, partial wing fuel, max payload Head/X Turb/ Approach Celling/ Rwy Wind, kt Gusts Category Visibility Surface Initial Position	ill aft fuselage f Rwy Surface	@ fwd C.G., fi Ceilling/ Visibility	Taxi Weight Approach Category	3. M13 - Max Turb/ Gusts	Loading: Head/X Wind, kt
. 0. No Failures	211. Transition to Climb 1. Light Turb.	tion to Climb	211. Transi	iic Cruise	4C. Subsonic Cruise
		Jan. 10	1911	201.20	10 OF

Procedure-Evaluation Pilot (PF):

1. PF initiates 2000 FPM climb from initial straight & level conditions.

2. Pr smoothly applies power to maintain initial airspeed, heading, and wings level while maintaining desired climb rate.

3. Stabilize at 250 KEAS and target climb rate.

Procedure-Test Engineer / Pilot Not Flying (PNF): 1. Confirm initial conditions.

39

3050

10-Jan-97 EBJ

Date:

Pilot:

**Profile Descent** 

3050

Initial Position Weather State 0. No Weather Rwy Surface Dry, grooved ight & CG varies
Approach Category Vi MIE Loading: X. Misc. - V Head/X Turb. Wind, kt Gusts O KV None/ 0 Kt None Flight Phase

Abnormals/Exceptions:	_					
	NORMAL				~~	
PSCAS	RSCAS	A/T	HUD	F/D	Config	
. Trim	°					
EPF	RVC					
000,49		Various	Various	đ	Auto	
ALT	KEAS/M	્ક		GEAR	LEF/TEF	

Procedure-Evaluation Pilot (PF):

1. PF establishes a normal descent maintaining initial heading and bank angle.

2. Follow Vmo line on velocity-altitude display until reaching final conditions (15,000 ft and 250 KEAS).

Procedure-Test Engineer / Pilot Not Flying (PNF): 1. Confirm initial conditions.

End Evaluation:	15,000 ft, 250 KEAS			
Evaluation Basis: Evalu	Evaluation Basis: Evaluate handling qualities of the airplane in descent. Check gust sensitivity in descent.	lane in descent. C	heck gust sensiti	vity in descent.
Performs	Performance Standards	Target	Desired	Adequate
Bank Angle Control (deg		٥	±2	01∓ 1
Deviation in Scheduled A	irspeed (knots)	0	££	±20
Deviation in Heading (der	(S	0	±2	#

Transition to Supersonic Descent

3060

Initial Position	N/A	Abnormals/Exceptions:	None.				
Rwy Surface	Dry, grooved	RMAL A	RMAL NO	OFF	NO	OFF	٠ ١٠
Ceiling/ Visibility	Unlimited/ Unlimited	R Trim PSCAS NORMAL Abn	RSCAS NO	A/T	HUD	F/D	Config Roft
Approach Category	0	EPR Trim	R/C 0				
Turb/ Gusts	Light/ None	63,700	M 2.4	384,862	53.2	dD	Anto
Head/X Wind, kt	0 KV 0 Kt	ALT	KEAS/M M 2.4	85	ပ	GEAR	I RE/TER

Runs:

Pilot:

Procedu 1. Confi

Performance Standards
Maximum Overshoot in Target Descent Rate
Deviation in Airspeed/Mach (KEAS)
Deviation in Heading (deg)
Deviation in Bank Angle (deg) Procedu 1. PF es 2. PF ra 3. Repe LEF/1

<del>-</del>										ŀ	1	1 1	j		1	l	le
7.1	Adequate +300	±10/0.02M	±4 ±5														3060
Pacific A	Desired +200	±5/0.01M	±2 ±2														
ľ	1 arget		00														
Dorformonce Ctondonde	Maximum Overshoot in Target Descent Rate	Deviation in Airspeed/Mach (KEAS)	Deviation in Heading (deg.) Deviation in Bank Angle (deg.)														
	EPR Trim! PSCAS	R/C 0 RSCAS NORMAL	GW 384.862 A/T OFF C.G. 53.2 HUD ON OFF	on Pilot (PF): ght and level flight at the noted cond over to attain a constant descent rate e cent rates of 2000 fpm and 4000 fpm	edure—Test Engineer / Pilot Not Flying (PNF):												09

10-Jan-97 EBJ

Date:

Runs:

**Transition to Transonic Descent** 

3062

Flight	t Phase	Σ	TE	Weather State	State	Failures
10C. Trans	IOC. Transonic Cruise	221. Transition to Descent	ion to	1. Light Turb.	Π	0. No Failures
Loading:	oading:   7. MFC - Final Cruise condition	Cruise condi	tion			
Head/X	Turb/	Approach	Ceiling/	Rwv		
Wind, kt	Gusts	Category	Visibility	Surface	In	Initial Position
o Ke	Light/	0	Unlimited/	D.Y.		N.A
0 Kt	None		Unlimited	grooved		

T WILLIAM	0. No Failures		Initial Position	N/A	xceptions:				
	Turb.				Abnormals/Exceptions:	None.			
	1. Light Turb.		Rwy Surface	Dry, grooved	NORMAL	ORMAL	50	OFF	H Cyc 3
	tion to	lition	Ceiling/ Visibility	Unlimited		_	HUD	F/D	Config Ref H Cyc 3
	ZZI. Transition to Descent	al Cruise conc	Approach Category	0	EPR Trim PSCAS				
	IVC. Iransonic Cruise	.oading:   7. MFC - Final Cruise condition	Turb/ Gusts	Light/ None	2,000	4 862	53.2	an T	Auto
k	IOC. Irans	Loading:	Head/X Wind, kt	0 KV 0 Kt	ALT	AEAS/M R	် ပ	GEAR	LEF/TEF

Procedure–Evaluation Pilot (PF):

1. PF establishes straight and level flight at the noted conditions.

2. PF rapidly pitches over to attain a constant descent rate of 1000 fpm while maintaining airspeed.

3. Repeat test for descent rates of 2000 fpm and 4000 fpm.

Procedure-Test Engineer / Pilot Not Flying (PNF): 1. Confirm initial conditions.

End Ev	End Evaluation: Stabil Evaluation Basis: Check ability airspeed and flight path. Evaluat shall be smooth and continuous.	End Evaluation: Stabilized Descent at Constant Mach  Evaluation Basis: Check ability to maintain Mach during transition to descent. Evaluate coupling between airspeed and flight path. Evaluate handling qualities during power and configuration change. The transition shall be smooth and continuous.	t Mach g transition to desceng g power and config	ent. Evaluate cou	pling between The transition
	tion Basis: Check abilit I and flight path. Evalus smooth and continuous	y to maintain Mach duriny ate handling qualities durin i.	g transition to desceng power and config	ent. Evaluate cou	pling between The transition
Evalua	smooth and continuous	ا ا		•	
shall be					
	Performance Standards	Standards	Target	Desired	Adequate
Maxim	aximum Overshoot in Target Descent Rate	Descent Rate	0	∓200	∓400
Ceviatic	viation in Airspeed/Mach (KE	EAS)	0	±5/0.01M	±10/0.02M
Deviatic	eviation in Heading (deg)		0	±2	44
Deviatic	Peviation in Bank Angle (deg)		0	±2	¥

Desired

Target

Performance Standards

Deviation in Bank Angle (deg)
Deviation in Target Rate of Climb (fpm)
Deviation in Heading (deg)
OvershoovUndershoot in Airspeed (KEAS)

Runs:

Pilot:

3070

Airspeed Change In Subsonic Climb

Evaluation Segment: Airspeed Change in Climb/Descent (Subsonic) Long CHR [Lat / Dir CHR	Start Evaluation: Steady Flight at Initial Constant Aircnood	End Evaluation:		Evaluation Basis: Check ability to initiate climb during normal operations. Check for undesirable airsneed	coupling.	
	es Start Eval				coupling.	•
tate Failures	0. No Failur	, partial wing fuel, max payload		Initial Position	ΥN	
Weather State Failu	I. Light Turb. 0. No Failun	ll aft fuselage fuel, partial wing fuel, max	Rwy	Surface Initial Positi	Dry, NA	grooved
MTE Weather State Failu	peed Change   I. Light Turb.   0. No Failur	nt @ fwd C.G., full aft fuselage fuel, partial wing fuel, max	n Ceiling/ Rwy	v Visibility Surface Initial Positi	Unlimited Dry, NA	Unlimited grooved
MTE Weather State Failu	230. Airspeed Change   I. Light Turb.   0. No Failur	x Taxi Weight @ fwd C.G., full aft fuselage fuel, partial wing fuel, max	Approach Ceiling/ Rwy	Category Visibility Surface Initial Positi	0 Unlimited Dry, NA	Unlimited grooved
ht Phase MTE Weather State Failu	nic Climb 230. Airspeed Change 1. Light Turb. 0. No Failur	. 3. M13 - Max Taxi Weight @ fwd C.G., full aft fuselage fuel, partial wing fuel, max	Turb/ Approach Ceiling/ Rwy	Gusts   Category   Visibility   Surface   Initial Positi	Light 0 Unlimited Dry, NA	None Unlimited grooved

	N/A	Abnormals/Exceptions: None.	
	Dry, grooved		֭֭֭֭֭֭֭֭֡֝֟֝֟֝֜֜֜֜֜֜֟֜֜֟֜֜֟֜֜֟֓֓֓֓֜֟֜֜֟֜֜֟֓֓֓֓֜֟֜֜֜֟֜֜֟
	Julimited/ Unlimited	a	THIS ACT I
	ם ס	1000 1	3 -
_		EPR R/C	
	Light/ None	ALT 10,000 ALT 10,000 GW 649,914 C.G. 48.1 GEAR UP	•
	0 Kt/ 0 Kt	ALT 16 KEAS/M GW 64 C.G. GEAR	1001

									3070
LEF/TEF Auto Config RefH Cyc 3	Procedure—Evaluation Pilot (PF):  1. PF initiates 1000 FPM climb at the noted conditions.  2. PF smoothly applies power (up to MCT) to accelerate the airplane to 350 KEAS (or to the highest standard airspeed/Mach for the flight condition) while maintaining vertical speed, heading and wings level.  3. Subhizes at 350 KEAS and target climb rate.  4. PF smoothly reduces power to return to initial airpeed, while maintaining climb rate, heading, and bank angle.  5. Thrust may be adjusted to assist in the smooth performance of this maneuver.	Procedure-Test Engineer / Pilot Not Flying (PNF):  1. Confirm initial conditions.	42						3070

Date: 10-Jan-97 EBJ

Long CHR Lat / Dir CHR

Runs:

Pilot:

Airspeed Change in Supersonic Cruise

3072

Evaluation Segment: Aispeed Change in Level Flight (Supersonic)	Start Evaluation: Steady Flight at Initial Constant Airmand	End Evaluation: Greaty Elicht of New Constant Atlanta		Evaluation Bacie: Check shillips to adjust agreement during an angel of the contract of the co	coupling.
tate Failures	0. No Failures			Initial Position	NA
Weather State	ed Change [1. Light Turb.		Rwy	Surface	Dry, grooved
TTE	ed Change	tion	Ceiling/	Visibility	Unlimited Dry, Unlimited grooved
<b>№</b>	230. Airspe	al Cruise cond	Approach	Category	0
ht Phase	sonic Cruise	5. MIC - Initi	Turb/	Gusts	Light/ None
Fig	7A. Supen	Loading:	Head/X	Wind, kt	0 KV 0 Kt

Abnormals/Exceptions: Thrust Multiplier set to 1.09
NORMAL NORMAL OFF ON OFF Ref H Cyc 3
PSCAS RSCAS A/T HUD F/D Config R
Trim O
EPR R/C
50,000 450 614,864 52.5 UP Auto
KEAS/M GW C.G. GEAR LEF/TEF

Procedu 1. PF es 2. PF sr airsp 3. Stabi 4. PF sr angle 5. Thrus

Procedu 1. Confi

Supersonic Cruise	230. Airspe	230. Airspeed Change	1. Light Turb.	urb. 0. No Failures	Start Evaluation: Supersonic Auspeed Change in Level Flight (Supersonic)	Supersonic)	Long CHR	Lat / Dir CHR	
: 5.	utial Cruise cond	lition	1 1		End Evaluation: Steady Flight at Initial Constant Airspeed	virspeed			
ad/X Turb/	Approach	Ceiling/ Visibility	Rwy	_	Steady Light at Item Collisian All	naadsı			
	0	Unlimited	┼		Evaluation Basis: Check ability to adjust airspeed during normal operations. Check for undesirable airspeed coupling.	ormal operation	is. Check for und	esirable airspeed	
! !			Ι'		Performance Standards	Target	Desired	Adequate	
ALT 50,000	EPR Trim	PSCAS		Abnormals/Exceptions:	Deviation in Bank Angle (deg)	0	±2	±\$	
GW 614,864	>		NOKMAL	Thrust Multiplier set to 1,09	Deviation in Heading (ft)	0	∓30	±100	
C.G. 52.5 EAR UP		HUD OHE	NO S		Overshoots of Target Airspeed/Mach	ò	0	G 15	
		Coming Act	, CW2						
edure-Evaluatio F establishes straigh F smoothly applies rspeed/Mach for the	n Pilot (PF): It and level flight power (up to MC i flight condition	t at the noted co T) to accelerat 1) while mainta	onditions. te the airplane uning altitude,	edure—Evaluation Pilot (PF); Festablishes straight and level flight at the noted conditions. Fsmoothly applies power (up to MCT) to accelerate the airplane to 475 KEAS (or to the highest standard rspeed/Mach for the flight condition) while maintaining altitude, heading and wings level.					
F smoothly reduces power to return to initial airpeed, while maintaining climigle.  In the smooth performance of this maneuver.	power to return ed to assist in the	to initial airpee semooth perfor	ed, while main	F smoothly reduces power to return to initial airpeed, while maintaining climb rate, heading, and bank igle. hrust may be adjusted to assist in the smooth performance of this maneuver.			٠		
edure-Test Engineer / Pilot Not Flying (PNF); onfirm initial conditions.	neer / Pilot N tions.	ot Flying (P	'NF):						
					_				
			-						
2								0100	

Cong CHR Lat / Dir CHR

Airspeed Change in Level Flight (Transonic)

Evaluation Segment: Start Evaluation: End Evaluation:

Pllot:

Steady Flight at Initial Constant Airspeed Steady Flight at New Constant Airspeed

Runs:

Evaluation Basis: Check ability to adjust airspeed during normal operations. Check for undesirable airspeed coupling.

Adequate ±5 ±200 ±5 ≤1

Desired

Target

Performance Standards

Deviation in Heading (deg) Overshoots of Target Airspeed/Mach Seviation in Bank Angle (deg) Seviation in Altitude (ft)

Transonic Decel

3074

Fligh	nt Phase	M	TE	Weather State	State	Failures
9A. Transo	ansonic Decel	230. Airspeed	d Change	1. Light Turb.		0. No Failures
Loading:	7. MFC - Fina	ling: [7. MFC - Final Cruise condition	tion			
Head/X	Turb/	Approach	Ceiling/	Rwy		
Wind, kt	Gusts	Category	Visibility	Surface	Ĭ	Initial Position
0 KV	Light	0	Unlimited/	Dry,		N/A
0 Kt	None		Unlimited	grooved		

				Vication Diane	Callon V
	230. Airspo	230. Airspeed Change	1. Light Turb.	٥.	0. No Failures
Fina	Loading: 7. MFC - Final Cruise condition	lition			
Jack/	Approach	Ceiling/	Rwy		
Gusts	Category	Visibility	Surface		Initial Position
-	0	Unlimited/	Dry,		NA
None		Unlimited	grooved		
ALT 41,000  E	1	Trim PSCAS N	NORMAL	Abnormals/Exceptions:	xceptions:
	R/C 0	RSCAS NO		None.	
		A/T		i	
		HUD	NO O		
		F/D	OFF		
		Config Roth Cvc 3	- Con H		

Procedure–Evaluation Pilot (PF):

1. PF establishes straight and level flight at the noted conditions.

2. PF smoothly reduces power to decelerate the airplane to 0.90M (or to the highest standard airspeed/Mach for the flight condition) while maintaining altitude, heading and wings level.

5. Stabilize at 0.9M.

4. PF smoothly increases power to return to initial Mach number, while maintaining altitude, heading, and bank angle.

5. Thrust may be adjusted to assist in the smooth performance of this maneuver.

Procedure-Test Engineer / Pilot Not Flying (PNF): 1. Confirm initial conditions.

				3074
			* - 15 m;	
				3074
				က

10-Jan-97 EBJ

Date:

Subsonic Decel

3076

Fligh	Flight Phase	W	MTE	Weather State	State	Failures
12A. Low Altitude	Altitude	230. Airspeed Change		1. Light Turh		O No Failures
Cruise/Hold	-					
Loading:	7. MFC - Fins	Loading: [7. MFC - Final Cruise condition	tion			
Head/X	Turb/	Approach				
kt	Gusts	Category	Visibility	Surface		Initial Position
0 KV	Light	6	Unlimited	ı		AW
0 Kt	None		Unlimited	grooved		

Abnormals/Exceptions: Nonc.		Trim PSCAS NORMAL  O RSCAS NORMAL  A/T OFF  HUD OFF  F/D OFF	EPR Trim	ALT 15,000 E AS/M 330 I GW 384,862 C.G. 53.2 SEAR AUD	KEAS/M GW C.G. GEAR LEF/TEF
WA	Dry, grooved	Unlimited/ Unlimited	0	None	O Kt
Initial Position	Rwy Surface	Ceiling/ Visibility	Approach Category		Head/X Wind, kt
		ition	al Cruise cond	Loading: [7. MFC - Final Cruise condition	Loading:
. 0. No Failures	1. Light Turb		230. Airspeed Change	Altitude 1	12A. Low Altitude Cruise/Hold

Procedure—Evaluation Pilot (PF):

1. PF establishes straight and level flight at the noted conditions.

2. PF smoothly reduces power to decelerate the airplane to 250 KEAS (or to the highest standard airspeed/March for the flight condition) while maintaining altitude, heading and wings level.

3. Stabilize at 250 KEAS.

4. PF smoothly increases power to return to initial airspeed, while maintaining altitude, heading, and bank angle.

5. Thrust may be adjusted to assist in the smooth performance of this maneuver.

Procedure-Test Engineer / Pilot Not Flying (PNF): 1. Confirm initial conditions.

Evaluat Start Eva End Eval Evaluat coupling Deviation Deviation Deviation Overshoo	Evaluation Segment: Airspeed Change in Level Flight (Subsonic) Long CHR Lat / Dir CHR Start Evaluation: Steady Flight at Initial Constant Airspeed End Evaluation: Steady Flight at New Constant Airspeed	Evaluation Basis: Check ability to adjust airspeed during normal operations. Check for undesirable airspeed coupling.	Performance Standards Target Desired Adequate	Deviation in Bank Angle (deg) 0 ±2 ±5	Deviation in Altitude (ft) 0 ±100 ±200	Deviation in Heading (deg) 15 ±5	Overshoots of Target Airspeed/Mach
--	---	---	---	---------------------------------------	--	----------------------------------	------------------------------------

Runs:

Pilot:

|--|--|--|

Long CHR | Lat / Dir CHR

Evaluation Segment: Heading Change in Climb/Descent (Transonic)

Pilot:

Straight Flight on Initial Heading Straight Flight on New Heading

Runs:

Evaluation Basis: Evaluate handling qualities in turning flight. Perform maneuver with smooth roll-in and roll-out, with no tendency to oscillate or hunt for target bank angle throughout the maneuver.

3080

Heading Change in Transonic Climb

Evaluation Segm	Start Evaluation:	End Evaluation:		Evaluation Basis:	roll-out, with no ten	
Failures	0. No Failures	e fuel, partial wing fuel, max payload		Initial Position	N/A	
Weather State	1. Light Turb.	all aft fuselag		Surface	_	grooved
MTE	ng Change	@ fwd C.G., fi	Ceiling/		Unlimited	Unlimited
	240. Headi	: Taxi Weight	Approach	Category	0	
t Phase	ansonic Climb	.oading:   3. M13 - Max Taxi Weight @ fv		Gusts	Light	None
Fligh	5A. Transo	Loading:	Head/X	Wind, kt	0 Kv	0 Kr

Abnormals/Exceptions:	NORMAL NA NORMAL NA OFF ON OFF ON OFF OFF OFF OFF OFF	Trim PSCAS NC A/T HUD F/D F/D Config Ref.	EPR Trim	0.88 0.88 0.914 48.1 UP	ALT 26,000 KEAS/M M 0.88 GW 649,914 C.G. 48.1 GEATER AUP
bnormals/Exceptions:			1	1	ALT
N/A	Dry, grooved	Unlimited/ Unlimited	0	Light/ None	0 Kv 0 Kt
Initial Position	Rwy Surface	Ceiling/ Visibility	Approach Category	_	Head/X Wind, kt

	Adequate	±5	±500 +10/0 02M	±5 (≤1 overshoot)												3080	
ł	$\frac{1}{1}$		+	$oldsymbol{ol}}}}}}}}}}}}}}}}}}$													
	Desired	±2	±300 +5/0 01M	±2 (0 overshoots)													
	Larget	0	<b>-</b>  -	0							3						
				deg)													
	andards	e in lum (deg	rt (rr/m)	End of Turn (													
Ė	reriormance Standards	et Bank Angl	Climb/Descer	get Heading at													
	reri	tion from 1 ar	tion in Rate of	Deviation from Target Heading at End of Turn (deg)													
		e S S S	Devis Pevis	Devia													
					f climb. ntaining												
		ceptions:			) fv/min rate o												
		Abnormals/Exceptions:	je.		ng with a 1000 g a 15° bank ar												
grooved	_	NORMAL		SE S	cardinal head	Ë											
Unlimited	- 1			HUD ON FF	at 0.88M on a 30° turn to the be adjusted if bank.	Flying (PN											
1		R Trim PSCAS			ot (PF): eading climb to and out of a Thrust may l	/ Pilot Not				;							
None	- 1	000,000 EPR		48.1 UP	aluation Pil ady constant-l maneuver int rate of climb. uver to the LE uver using op	st Engineer ial conditions.											
0 Kt	*	ALT 26	CEAS/M M GW 649	GEAR UP	Ste	Procedure-Test Engineer / Pilot Not Flying (PNF): 1. Confirm initial conditions.										3080	
j	L	_	_		<b>1</b>	<u>~</u>	47			ļ	ı	I	1 1	1	I	1 1	

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Date:

Long CHR Lat / Dir CHR

Evaluation Segment: Heading Change in Level Flight (Supersonic)

Start Evaluation: and Evaluation:

Pilot:

Straight Flight on Initial Heading Straight Flight on New Heading

Runs:

Heading Change in Supersonic Cruise

3082

FIE	nt Phase	N M	MTE	Weather State	State	Fallures
A. Super	sonic Cruise	240. Headin	g Change	I. Light Turb.		0. No Failures
oading:	ing:   5. MIC - Initial Cruise condition	al Cruise condi	tion			
T(PES)	Turb/	Approach	Celling/	RWV		
Wind, kt	Gusts	Category	Visibility	Surface		Initial Position
0 KV	Light	0	Unlimited	Dry.		N/A
0 K	None		Unlimited	grooved		

-	Abnormals/Exceptions:	Thrust Multiplier set to 1 09	COLOR DE CAMPAGNETICA COLOR			
Cimilar Brown	NORMAL	NORMAL	O.	Ö	OFF.	Config Ref H Cyc 3
	PSCAS	RSCAS	A	HUD	F/D	Config
	Trim	0				
	EPR					
2	54,400	M 2.3	614,864	C.G. 52.5	UP	Anto
	ALT	KEAS/M	80		GEAR	LEF/TEF

- Procedure—Evaluation Pilot (PF):

  1. Establish straight and level flight at indicated conditions on a cardinal heading.

  2. Aggressively maneuver into and out of a 20° turn to the RIGHT using a 15° bank angle while maintaining airspeed and level flight. Thrust may be adjusted if necessary. Accept altitude loss to maintain Mach if
  - required.

    3. Repeat maneuver to the LEFT using 30° bank.

    4. Repeat maneuver using opposite directions of turn.

Procedure-Test Engineer / Pilot Not Flying (PNF): 1. Confirm initial conditions.

oll-out, with no tendency to oscillate or hunt for target bank angle throughout the maneuver.	ık angle through	out the maneuver.	
Performance Standards	Target	Desired	Adequate
Deviation from Target Bank Angle in Turn (deg)	0	±2	££
Deviation in Altitude (ft)	0	001∓	∓200
Deviation in Mach	0	∓0.01	±0.02
Deviation from Target Heading at End of Turn (deg)	0	±2 (0 overshoots)	15)5∓
			overshoot)

Heading Change in Supersonic Cruise

Fligh	nt Phase	Ψ	MTE	Weather State	State	Failures
Super	ersonic Cruise	240. Headin	g Change	1. Light Turb.		0. No Failures
ding:	7. MFC - Final C	al Cruise condition	tion			
Head/X	Turb/	Approach	Ceiling/	Rwy		
d, kt	Gusts	Category	Visibility	Surface	-	Initial Position
0 Kt/	Light/	0	Unlimited/	Dry,		N/A
0 Kt	None		Unlimited	grooved		

V	f				J
_	_				
NORMAL	NORMAL			_	Ref H Cyc 3
PSCAS	SCAS	A/T	HUD	FD	Config
Ľ	=		_		_
Trim	0				
EPR	R/C				
64,590	M 2.4	384,862	53.2	d D	Auto
ALT	<b>KEAS/M</b>	<b>₹</b>		GEAR	LEF/TEF

Procedure-Evaluation Pilot (PF):

1. Establish straight and level flight at indicated conditions on a cardinal heading.

2. Aggressively maneuver into and out of a 20° turn to the RIGHT using a 15° bank angle while maintaining airspeed and level flight. Thrust may be adjusted if necessary. Accept altitude loss to maintain Mach if

bnormals/Exceptions: hrust Multiplier set to 1.09

Pilot: Date:

Runs:

Long CHR | Lat / Dir CHR Evaluation Segment: Heading Change in Level Flight (Supersonic) Straight Flight on Initial Heading Straight Flight on New Heading Start Evaluation: End Evaluation:

Evaluation Basis: Evaluate handling qualities in turning flight. Perform maneuver with smooth roll-in and roll-out, with no tendency to oscillate or hunt for target bank angle throughout the maneuver.

Performance Standards	Target	Desired	Adequate
Deviation from Target Bank Angle in Turn (deg)	0	= ±2	<del>‡</del> 2
Deviation in Altitude (ft)	0	7100	∓200
Deviation in Mach	0	10.0±	±0.02
Deviation from Target Heading at End of Turn (deg)	0	±2 (0 overshoots)	<b>±5</b> (≤l
			overshoot)

3084

Procedure-Test Engineer / Pilot Not Flying (PNF): 1. Confirm initial conditions.

Repeat maneuver to the LEFT using 30° bank.
 Repeat maneuver using opposite directions of turn.

10-Jan-97 EBJ

Date:

Runs:

Pllot:

Heading Change in Low Attitude Cruise

3086

Filgh	Phase	M	TE	Weather	State	Fallures	Evaluation Segment: Heading Change in Level Flight (Subsemie)		Long CHR ILat / Dir CHR	at / Dir CHR
12A. Low A Cruise/Hold	Altitude	240. Heading	g Change	1. Light Turb.	0	0. No Failures	Start Evaluation: Straight Flight o			
Loading:	7. MFC - Fina	d Cruise condit	tion					Straight Flight on New Heading		
Head/X	Turb/	Approach	Celling/	Rwy			Evaluation Basis: Evaluate handling qualities in turning flight. Perform maneuver with smooth roll-in and	lities in turning flight. Perform r	naneuver with smoo	th roll-in and
1	Sansta	CHICKOLY	VISIDINTY	Surrace	Imi	Initial Position	Foll-out, with no tendency to oscillate or hunt for target bank angle throughout the maneuver	ant for target bank angle through	but the maneuver	
O KC	Light	0	Unlimited	Ď.		N/A	•			
U Kt	None		Unlimited	grooved			Performance Standards	Toront Market	T Parities I	1 100000

				A4000 TARREST	******	
12A. Low Altitude Cruise/Hold	Altitude d	240. Heading Change	ng Change	1. Light Turb.		0. No Failures
Loading:	Loading: 7. MFC - Final Cruise condition	al Cruise conc	lition			
Head/X Wind, kt	Turb/ Gusts	Approach Category	Ceiling/ Visibility	Rwy Surface	Ī	Initial Position
0 Kt/ 0 Kt	Light/ None	0	Unlimited	Dry, grooved		NA
ALT		EPR Trim	Trim PSCAS NO	NORMAL AB	Abnormals/Exceptions:	eptions:
<b>KEAS/M</b>			O RSCAS NO	NORMAL	2	
<b>≥</b>	384,862		Υ	OFF	•	
ပ	53.2		HUD	Š		
GEAR	GEAR UP		F/D	OFF.		
LEF/TEF	Auto		Conflie Ref H Cvc 3	7 Cyc 3		

Procedure—
1. Establish
2. Aggressiv
airspeed a
3. Repeat m
4. Repeat m

Procedure-1. Confirm

None	Unlimited	grooved	VX	Performance Standards	Taront	Destroy	Adecinote	
		•		Deviation from Target Bank Angle in Turn (deg)	6	17.11.57	)+	
EPR Trim	PSCAS	NORMAL	Abnormals/Exceptions:	Deviation in Altitude (ft)	P	1001	+200	
K/C 0	RSCAS		None.	Deviation in Airspeed (KEAS)	0	<b>‡</b>	017	
3. 53.2 D 110	HOP	18		Deviation from Target Heading at End of Turn (deg)	0	±2 (0 overshoots)	±5 (≤1 overshoot)	
F Auto	Config Ref H Cyc 3	H Cyc 3						
re-Evaluation Pilot (PF); lish straight and level flight at i ssively maneuver into and out	indicated conditic of a 60° turn to th	ons on a card the RIGHT us	re-Evaluation Pilot (PF); lish straight and level flight at indicated conditions on a cardinal heading. ssively maneuver into and out of a 60° tum to the RIGHT using a 30° bank angle while maintaining					
ed and level flight. Thrust may be adjusted if it maneuver to the LEFT. it maneuver using opposite directions of tum.	ty be adjusted if r ections of turn.	necessary.						
re-Test Engineer / Pilot Not Flying (PNF); rm initial conditions.	Not Flying (Pl	NF):						
***								
					-			
	•							
							3086	

10-Jan-97 EBJ

Long CHR Lat / Dir CHR

Heading Change in Climb/Descent (Subsonic)

Pilot:

Straight Flight on Initial Heading Straight Flight on New Heading

Start Evaluation: End Evaluation:

Runs:

Evaluation Basis: Evaluate handling qualities in turning flight. Perform maneuver with smooth roll-in and roll-out, with no tendency to oscillate or hunt for target bank angle throughout the maneuver. Evaluation Segment: Date: Failures Initial Position NA 0. No Failures Heading Change in Class B Descent Weather State 1. Light Turb. Rwy Surface Dry, grooved Celling/ Visibility Unlimited/ Unlimited 3A. Descent into Class B 240. Heading Change Approach Category Vi MTE Airspace

Loading: 7. MFC - Final C
Head/X Turb/ A
Wind, kt Gusts C
0 Nt Light
O Kt None 3088

Abnormals/Exceptions:	None				
NORMAL	NORMAL	OFF	NO O	OFF	Ref H Cyc 3
PSCAS	RSCAS	Α⁄Τ	HUD	F/D	Config
Trim	90 <u>-</u>				
_	RC				
10,000	250	384,862	53.2	UP	Auto
ALT	KEAS/M	85	C.G.	GEAR	LEF/TEF

_	
Flying	
Š	
Pilot	
_	
Engineer	
Ocedure-Test	
<u>.</u>	•

	O.K.	Light	_	-	Unlimited		<u>۔</u>		×			_				,	,			
	0 Kt	None			Unlimited		grooved						Perf	ormance	Performance Standards	Target	L	Desired	Adequate	
1						1						Deviat	on from Tare	et Bank An	Deviation from Target Bank Angle in Turn (dea)		$ar{\parallel}$	23.64	A TOTAL	,
L		1 2 2 2 2 1			1		Ξ				ſ		1101110	Ct Dalla All	gie ili i uin (ueg)	}		77	A	
	ALI	000,01	T.	Inm PSCAS		NOKMAL		ormals/E	xception	S:		Deviat	on in Kate of	Climb/Desc	cent (fr/m)	0		90G	#200 #200	
_	KEAS/M	530		- 000 - X		NOKMA		None.				Deviati	on in Airspec	d (KEAS)	Deviation in Airspeed (KEAS)	0		±5	∓10	_
	 ⊗	184,862			ΑŢ	OFF	_					Deviati	on from Tare	et Heading	at End of Turn (dea)	_	5	+) (A cyarchoote)	12/3+	-
	ပ	53.2		_	HUD	S O	_				_				(g.,)	•	Ĺ	(2000)	overshoot	
	GEAR	d D			F/D	OFF	t z				_								(100000)	_
<u></u>	LEF/TEF Auto	Auto		J	Config Ref H Cyc 3	ef H Cyc.					7									
J																				
-	December 19 and	D	7	(100)																
	Fetablish	eteady deco	in Fillot	vardinal he	andina															
	Aggressiv	steady dest	er into	ed out of a	60° turn	DIG!	JT ucing	150 hank	Jidan alaan	a urbile maintena	•	-								
1	airmeed and -1000 film decrete. Thrust may be adjusted if necessary	nd - 1000 fi	/m desce	of Thrus	t may be a	dineted if	Suren 11	T Daily	angic will	c mannaniii	žo.									
~	Reneal	anenver to f	he I FFT	using 30°	hank	ii America	, moceana													
4.	Repeat m	ancuver usi	ng oppos	ite direction	ons of turn	یہ														
	•																			
<u>a</u>	Procedure-Test Engineer / Pilot Not Flying (PNF):	Test Engi	neer / l	Pilot Not	Flying	(PNF):														
-	Contiem	nitial condi	itions.																	
											_	_								
5																				
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-	3088																		3088	œ

31-Oct-96 DLR

Date:

Runs:

Pilot:

Nominal Approach & Landing

4020

3	Ø	7	Ż	Lĕ	٣	_	L
_		_	_	_	_		_
Failures	0. No Failures			Initial Position	nm outside OM; On course for 30°	intercept of LOC; 4,500 right of	centerline
Weather State	ė				3 nm outsi	intercep	
Weath	1. Light Tu		_	Surface	Dry,	grooved	
MTE	ete Approach	ition	Celling/	Visibility	Unlimited/	Unlimited	
M	1313. Comple and Landing	al Cruise cond	Approach	Category	0		
ight Phase	5A. Initial Approach Fix 313. Complete Approach 1. Light Turb. and Landing			Gusts	Light/	None	
Filg	15A. Initia	Loading:	Head/X	Wind, kt	0 Kv	o K	

Abnormals/Exceptions: Nonc.
NORMAL NORMAL ON ON OFF
PSCAS RSCAS A/T HUD F/D Config
159 159 125
Vapp Vref Vg/a Vmin
1,500 190 384,862 53.2 UP Auto
ALT KEAS/M GW 38 C.G. GEAR LEF/TEF

Procedure—Evaluation Pilot (PF):

1. Establish aircraft in steady level flight at the noted conditions, on intercept course for LOC.

2. Slow to Vapp when instructed by PNF.

3. Capture LOC. Track LOC to G/S intercept and capture G/S.

4. Disconnect autothrottles at 50 ft ACI.

5. Manually retard throttles and execute a flare to touchdown at the target point on the runway.

6. After touchdown, retard throttles to idje and lower the nosewheel to the runway.

Procedure—Test Engineer / Pilot Not Flying (PNF):

1. Confirm initial conditions.
2. Set Vapp as commanded speed at DME 7.0
3. 1/2 dot before G/S capture, call "Gear Down" and move gear handle to the down position

Start Evaluation: Clidestope and Localizer Intercept	• ebt	Long CHK	Lat / Dir CHR
End Evaluation: 200 ft AGI, Landing Speed, Descending	Level scending		
Evaluation Basis: Evaluate the ability to accurately maneuver onto the final approach path and maintain nominal approach profile and speed at low altitudes. Attained trimmed flight before the middle marker (approximately 0.5 nm from the end of the runway).	uver onto the fin ed trimmed flight	al approach path a I before the middle	ind maintain marker
Performance Standards	Target	Desired	Adequate
Deviation from Final Approach Airspeed (kt)	0	ŧ	01 <del>T</del>
Deviation from Glideslope (dots)	0	₹0.3	0.1±
Deviation from Localizer (dots)	0	±0.5	£1:0
Evaluation Segment: Precision I andino		and one	I st / Dir CHB
Start Evaluation: 200 ft AGL, Landing Speed, Descending End Evaluation: Nosewheel touchdown	scending		
Evaluation Basis: Evaluate handling qualities in landing. For desired performance, there should be no tendency to PIO or bobble in pitch or roll. There should also be no tendency to float or bounce after touchdown. There should be no geometry strikes on touchdown.	For desired perfo be no tendency lown.	formance, there she to float or bounce	nould be no e after
Performance Standards	Target	Desired	Adequate
Deviation from Approach Airspeed at 50 ft (kt)	0	\$‡	017
Deviation from Runway Heading at touchdown (deg)	0	£Ŧ	9∓
Longitudinal distance from threshold at touchdown (ft)	1250	1000-1500	750-2250
Lateral offset from runway centerline at touchdown (ft)	0	01∓	±27
Sink Kate at touchdown (ft/sec)	<b> </b>	₹5	15
Maximum Bank Angle below 50 ft AGL (deg)	0	∓\$	4
Pilot Induced Oscillations (PIO)	No PIO	OId oN	Not Divergent
Geometry Strikes (tail, engine nacelle, wing tip)	No Strikes	No Strikes	No Crates

Pilot:

## IAG Lateral Offset Landing

Fligh	it Phase	M	MTE	Weather State	State	Failures
15B. Mane	SB. Maneuver to Final	314. Approach and	ch and	11. Light Turk	o. w/Gusts	11. Light Turb. w/Gusts   0. No Failures
Approach Fix	ř	Landing from Lateral	n Lateral	)		
		Offset				
Loading:	oading: 7. MFC - Final Cruise condition	I Cruise condi	tion			
Head/X		Approach	Ceiling/	Rwy		
Wind, kt		Category	Visibility	Surface	=	Initial Position
0 Kt/	Light	0	Unlimited/	Dry,	Outsid	Sutside OM, at 1,000 AGL
0 Kt	None		Unlimited	grooved		

ALT	1,500	Vapp	159	PSCAS	NORMAL	Abnorn
KEAS/M	159	Vref	154	RSCAS	NORMAL	_
<b>₹</b>	384,862		159	A/T	Ö	
	53.2		125	HUD	NO.	onic sinc
GEAR	NWO N			F/D	OFF	2
LEF/TEF	Auto			Config	œ	glideslop
1	Auto			Config	2	g

lizer should be offset 300 feet to n the runway threshold, and the of the runway centerline, 1581 pe set to 2.50°.

Note: Procedure should be repeated for a total of 3 approaches and landings. Turbulence and discrete gusts added on second and third approaches.

- Procedure-Evaluation Pilot (PF):

  1. Establish aircraft in steady level flight on downwind, dog-leg, or straight-in for LOC capture, as called for by test engineer, for G/S intercept.
- - Maintain Vapp.
     Establish turn at no less than 3 miles from runway threshold and descend in altitude as required to track
    LOC to G/S intercept and capture G/S.
     Track LOC and G/S using HUD, following the offset localizer raw data.
     When PNF calls "Correct". Per Visially manuvers as required to correct for the lateral offset and set up for a touchdown at the target point on the runway.
     Disconnect autothrottles as 150 ft AGL.
     Manually adjust throttles as required and execute a flare to touchdown at the target point on the runway.
     If not in TIFS, after touchdown, retard throttles to idle and lower the nosewheel to the runway.

## Procedure-Test Engineer / Pilot Not Flying (PNF): Confirm initial conditions.

- During approach, PNF monitors any performance indicators that will not be automatically reported at the end of the run.
  - 3. At 250 ft AGL, call "Correct"

Evaluation Segment: IAG Approach	IAG Approach		Long CHR	Long CHR   Lat / Dir CHR
Start Evaluation: End Evaluation:	1,000 ft AGL, Final Approach Speed, Level 50 feet AGL, Pre-Flare, Descending	Speed, Level nding		
Evaluation Basis: Evalus nominal approach profile maneuver aircraft into lan landing conditions.	Evaluation Basis: Evaluate the ability to accurately maneuver onto the final approach path and maintain nominal approach profile and speed down the Decision Height (when "Correct" is called). Evaluate the ability to maneuver aircraft into landing line-up from offset ILS approach guidance and establish satisfactory pre-flare landing conditions.	euver onto the fina cight (when "Corre proach guidance an	ul approach path a xt" is called). Eva d establish satisfa	nd maintain Iuate the ability to ctory pre-flare
Performa	Performance Standards	Target	Desired	Adequate
Deviation from Approach	Deviation from Approach Airspeed (kt) [AGL > DH]	0	<b>\$</b> ∓	01∓
Deviation from Glideslope (dots) [AGL > DH]	e (dots) [AGL > DH]	0	∓0.5	41.0
Deviation from Localizer (dots) [AGL > DH]	(dots) [AGL > DH]	0	∓0.5	71.0
		,	2.51	

Long CHR Lat / Dir CHR		task. For desired performance, the wn and there should be no tendency at in flare. There should be no
Evaluation Segment: IAG Landing	Start Evaluation: 50 ft AGL, Pre-Flare, Descending End Evaluation: Main Gear Touchdown (Nosewheel Touchdown if not in TIES)	Evaluation Basis: Evaluate handling qualities in landing for a high-gain task. For desired performance, the pilot should be able to precisely and positively control the aircraft touchdown and there should be no tendency to PIO or bobble in pitch and roll. There should also be no tendency to float in flare. There should be no geometry strikes.

Performance Standards	Target	Desired	Adequate
Longitudinal distance from threshold at touchdown (ft)	1250	1000-1500	750-2250
Lateral offset from runway centerline at touchdown (ft)	0	01∓	±27
Sink Rate at touchdown (ft/sec)	V	≥4	<i>L</i> S
Maximum Bank Angle below 35 ft AGL (deg)	0	±5	17
Pilot Induced Oscillations (PIO)	No PIO	No PIO	Not Divergent
Geometry Strikes (tail, engine nacelle, wing tip)	No Strikes	No Strikes	No Strikes

10-Oct-96 DLR

Date:

Runs:

30' Go-Around with Minimum Altitude Loss

4085

and the light and	CITAL CHANGE CHANGE		contacting the runway	icy to PIO or bobble in	red Adequate	#	0 <30	01∓	10 Not Divergent	ikes No Strikes
000			de without	no tenden	Desired	Œ	2>	₹	No PIO	No Strikes
Armin	eed, Descending		om a very low altitu	uice, urere snouid de	Target	0	<20	0	No PIO	No Strikes
Evaluation Segment: Minimum Altitude I are Go Armand	Start Evaluation: 30 AGL, Final Approach Speed, Descending	Card Evaluation: Stabilized Climb Flight Path	Evaluation Basis: Evaluate the ability to go around from a very low alitude without contacting the runway	pitch or roll. There should be no geometry strikes	Performance Standards	Overshoot of Target Flight Path (deg)	Altitude Loss (ft)	Bank Angle Control (deg)	Pilot Induced Oscillations	Geometry Strikes (tail, engine nacelle, wing tip)
Veather State Fallures	ia - Lt. Turb 6. No Failures		Initial Position	On G/S and LOC about 3 miles from touchdown, at 750 feet AGL		Abnormals/Exceptions:	None.			
West	301. Cat II	I, Fwd C.G.	Rwy Surface	Dry, grooved				N N	2	- E
TTE	907. Go-Around - Min Alti 301. Cat Illa - Lt. T	uel+Wing Fue	Ceiling/ Visibility	50 ft/ 600 ft		159 PSCAS NORMAL		50 TA A T	HID	F/D
	307. Go-Arr Loss	Ing:   16. M3F - MZFW+Body Fuel+Wing Fuel	Approach Category	3A		/app 159	-		Vmin 125	-
ht Phase	8u	16. M3F · M.	Turb/ Gusts	Light/ None		2.50 2.50 2.50 2.50 2.50 3.50 3.50 3.50 3.50 3.50 3.50 3.50 3	200	GW 384 862 V		DOWN
Fligh	pua-	ing:	icad/X /ind, kt	2.2		ALT	KFASAM	3		GEAR

Abnormals/Exceptions	~					
159 PSCAS NORMAL		NOKMAL	S	Z	OFF.	Ref H Cyc 3
PSCAS	2	KSCAS	AT	IZS HUD	7.D	Config
		4	159	125		
Vapp			4 % ( )			
750	PG:	20,00	384,802	5.74	2	Auto
ALT	700101	NEAS/M	ي ₹	<u>؛</u> ؤز	CEAR	LEF/TEF

±3 <30 ±10 Not Divergent No Strikes

Procedure—Evaluation Pilot (PF):  1. Establish aircraft on LOC and G/S.  2. Maintain Vapp.  3. Track LOC and G/S using HUD.  4. When PIF calls "Go-round," pitch nose up to capture a target flight path angle of 12°, while simultaneously pushing the TO/GA button and advancing throttles to go-around thrust. The time to initially acquire the target flight path angle should be 7 sec.  5. Terminate test when target climb pitch attitude has been established and stabilized.	Procedure—Test Engineer / Pilot Not Flying (PNF):  1. Confirm initial conditions.  2. During approach, PNF monitors any performance indicators that will not be automatically reported at the end of the run.  3. At 30 feet radio altitude, call out "Go-Around".						

Date: 4-Oct-96 DWD

Runs:

Pilot:

50' Go-Around with Minimum Altitude Loss

Fligh	it Phase	M	TE	Weather	State	Failures
17E. Landing	Bui	307. Go-Arc Loss	ound - Min Alt	Go-Around - Min Alt 301. Cat Illa - Lt. Turb	. Lt. Turb	0. No Failures
Loading:	21. MLWF - Min L	Min Landing \	Weight, Fwd C	.G.		
Head/X	Turb/	Approach	Ceiling/	Rwy		
Wind, kt	Gusts	Category	Visibility	Surface	Ē	Initial Position
0 KV	Light	3A	/J 0S	Dry,	On G/S and	On G/S and LOC about 3 miles from
0 Kt	None		£009	grooved	touchdo	touchdown, at 750 feet AGL

Abnormals/Exceptions:	None	<u>.                                    </u>				
NORMAL				NO O		~~
PSCAS		RSCAS	¥Τ	HUD	F/D	Config /
143		138	143	112		
Vapp			V2/2	•		
750	AGL	143	307,000	84	N N	Auto
ALT		KEAS/M	85	C.G.	GEAR	LEF/TEF

- Procedure—Evaluation Pilot (PF):

  1. Establish aircraft on LOC and G/S.

  2. Maintain Vapp.

  3. Track LOC and G/S using HUD.

  4. When PNF calls "Go-round" pitch nose up to capture a target flight path angle of 12°, while simultaneously pushing the TO/GA button and advancing throutes to go-around thrust. The time to initially acquire the target flight path angle should be 7 sec.

  5. Terminate test when target climb pitch attitude has been established and stabilized.

- Procedure—Test Engineer / Pilot Not Flying (PNF):

  1. Confirm initial conditions.
  2. During approach, PNF monitors any performance indicators that will not be automatically reported at the end of the run.
  3. At 50 feet radio altitude, call out "Go-Around".

		Evaluation Segment: Minimum Altitude Loss Go-Around	puno	Long CHR	Long CHR Lat / Dir CHR
		Start Evaluation: 50' AGL, Final Approach Speed, Descending End Evaluation: Stabilized Climb Flight Path	, Descending		
ss from		Evaluation Basis: Evaluate the ability to go around from a very low altitude without contacting the runway with a minimum of airspeed loss. For desired performance, there should be no tendency to PIO or bobble in pitch or roll. There should be no geometry strikes	a very low altitud s, there should be	le without contact no tendency to Pl	ting the runway IO or bobble in
		Performance Standards	Target	Desired	Adequate
	_	Overshoot of Target Flight Path (deg)	0	±2	#3
		Altitude Loss (ft)	<20	¢20	<30
	_	Bank Angle Control (deg)	0	±5	₹10
		Pilot Induced Oscillations	No PIO	No PIO	Not Divergent
		Geometry Strikes (tail, engine nacelle, wing tip)	No Strikes	No Strikes	No Strikes
1	_				

S-Dec-96 DLR

Date:

Cong CHR | Lat / Dir CHR

Runs:

Adequate

Desired

Target

±0.5 ±0.5

Deviation from Final Approach Airspeed (kt)
Deviation from Glideslope (dots)
Peviation from Localizer (dots)

Performance Standards

25 Kt Crosswind Approach and Landing

4093

TO THE THE PART OF THE	7 10 100		al approach path and maintain	
Evaluation Segment: Glideslane and I ocalizer Internant	1,500 ft, Final Approach Speed, Level	200 ft AGL, Landing Speed, Descending	Evaluation Basis: Evaluate the ability to accurately maneuver onto the final approach path and maintain nominal amorpous home first and exceed at low altitudes. Attained trimmed flight halfore the middle of the page of the	from the end of the runway).
Evaluation Segmen	Start Evaluation:	Caro Esvaluation:	Evaluation Basis: Eve	(approximately 0.5 nm
Fallures	swind 0. No Failures		Initial Position	1/2 mi outside OM, at 1,500 feet AGL, on LOC.
Weather State	. 25 Kt Crosswind		kwy Irface I	Dry, 1/2 mi or grooved
TE	te Approach 30A	tion	Ceiling/	Unlimited gn
M	313. Comple and Landing	al Cruise condi	Approach Category	0
nt Phase	euver to Final Fix	7. MFC - Fin.	Turb/ Gusts	Moderate/ None
FILE	15B. Man Approach i	Loading:	Head/X Wind, kt	0 Kt/ 25 Kt

Abnormals/Exceptions:	None				
	NORMAL				ď
PSCAS	S4 RSCAS	Α⁄T	HUD	F/D	Config
<u>6</u>	<u>x</u>	159	125		
Vapp	Vref		•		
1,500 [	139	384,862	53.2	<b>X</b> 00	Auto
 ALT	<b>KEAS/M</b>	ĕ	C.G.	GEAR	LEF/TEF

Note: X-wind decreases linearly from 35 kt at 1000 ft AGL to 25 kt at steld elevation.

Procedure-Evaluation Pilot (PF):

1. Establish aircraft in steady level flight at the noted conditions, tracking the LOC for G/S intercept.

2. Maintain Vapp.

3. Track LOC to G/S intercept and capture G/S using HUD or PFD.

4. Procedure A: Disconnect autothrotiles at 50 ft AGL.

5. Procedure A: At 50 ft AGL, initiate a decrab and flare maneuver to touchdown at the target point. Max bank angle 5 deg.

6. Procedure B: At 200 ft AGL, initiate a forward slip (max bank angle 5 deg).

7. Procedure B: Disconnect autothrotiles at 50 ft AGL.

8. Procedure B: Execute a flare to touchdown at the target point on the runway. Max bank angle is 5 deg.

9. After touchdown, retard throtiles to idle and lower the nosewheel to the runway.

Procedure—Test Engineer / Pilot Not Flying (PNF):

1. Confirm initial conditions.

2. During approach, PNF monitors any performance indicators that will not be automatically reported at the end of the run.

End Evaluation:	200 ft AGL, Landing Speed, Descending Nosewheel touchdown	scending		
Evaluation Basis: E tendency to PIO or b touchdown. There sh	Evaluation Basis: Evaluate handling qualities in landing. For desired performance, there should be no tendency to PIO or bobble in pitch or roll. There should also be no tendency to float or bounce after touchdown. There should be no geometry strikes on touchdown.	;. For desired perf so be no tendency down.	ormance, there sh to float or bounce	ould be no after
Perfo	Performance Standards	Target	Desired	Adequate
Deviation from Appr	Seviation from Approach Airspeed at 50 ft (kt)	0	±5	01∓
Deviation from Runs	Deviation from Runway Heading at touchdown (deg)	0	£Ŧ	9∓
Longitudinal distance	ongitudinal distance from threshold at touchdown (ft)	1250	1000-1500	750-2250
Lateral offset from n	ateral offset from runway centerline at touchdown (ft)	0	01∓	±27
Sink Rate at touchdown (ft/sec)	wn (ft/sec)	I>	\$2	1.5
Maximum Bank Ang	Maximum Bank Angle below 50 ft AGL (deg)	0	£	<b>L</b> Ŧ
Pilot Induced Oscillations (PIO)	tions (PIO)	No PIO	OId oN	Not Divergent
Geometry Strikes (ta	Geometry Strikes (tail, engine nacelle, wing tip)	No Strikes	No Strikes	No Strikes

Runs:

Pilot:

# 35 Kt Crosswind Approach and Landing

	_		_			
Failures	0. No Failures			Initial Position	/2 mi outside OM, at 1,500 feet	AGL, on LOC.
Weather State	31. 35 Kt Crosswind		Rwy	Surface		grooved
MTE	Approach	tion	Celling/	Visibility	Unlimited/	Unlimited
W	313. Complete and Landing	al Cruise condi	Approach	Category	0	
nt Phase	r to Final	7. MFC - Fin	Turb/	Gusts	Moderate/	None
FIIE	15B. Maneuve Approach Fix	Loading:	Head/X	Wind, kt	0 KV	35 Kt

Abnormals/Exceptions:	None				
NORMAL	NORMAL	NO O	NO O	판	Ref H Cyc 3
PSCAS	RSCAS	A/T	HUD	F/D	Config
159	154	159	125		
	Vref				
1,500	159	384,862	53.2	NMO NMO	Auto
ALT	KEAS/M	80	ပ <u>်</u>	GEAR	LEF/TEF

Note: X-wind decreases linearly

Procedure–Evaluation Pilot (PF):

1. Establish aircraft in steady level fligl
2. Maintain Vapp.
3. Track LOC for G/S intercept and cap
4. Procedure A: Disconnect autothrouth
5. Procedure A: Disconnect autothrouth
bank angle 5 deg.
6. Procedure B: At 200 ft AGL, initiate brocedure B: At 200 ft AGL, initiate of Procedure B: Disconnect autothrouth
7. Procedure B: Disconnect autothrouth
8. Procedure B: Execute a flare to tone
9. After touchdown, retard throttles to

Procedure—Test Engineer / Pilo 1. Confirm initial conditions. 2. During approach, PNF monitors a end of the run.

omplete Anding	omplete Approach	31. 35 Kt Crosswind	osswind 0. No Failures	Si	Start Evaluation: 1,500 ft, Final Approach Speed, Level End Evaluation: 200 ft AGL, Landing Speed, Descending			
ų ž	Celling/ Visibility	Rwy Surface	Initial Position	B 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	Evaluation Basis: Evaluate the ability to accurately maneuver onto the final approach path and maintain nominal approach profile and speed at low altitudes. Attained trimmed flight before the middle marker	o the final ed flight b	approach path are fore the middle	nd maintain marker
	Unlimited	Brooved	1/2 mi outside OM, at 1, AGL, on LOC.	,500 feet	(approximately 0.5 nm from the end of the runway).			
					Performance Standards   Target	get	Desired	Adequate
59 P	PSCAS NO	NORMAL AI	Abnormals/Exceptions:		Deviation from Final Approach Airspeed (kt)		±5	0]Ŧ
4 5 S S	-		None.		Deviation from Localizer (dots) 0		±0.5 ±0.5	0:1 <del>1</del> 0:1 <del>1</del>
	E/D	SE,			Evaluation Segment: Precision Landing		and out	Tot / Dir. (1918
	m 45 kt at 1000 ft	1000 ft AGL	from 45 kt at 1000 ft AGL to 35 kt at ffeld elevation.					
F): Right at capture	F); light at the noted conditions, trac capture G/S using HUD or PFD.	nditions, trackii IUD or PFD.	F); light at the noted conditions, tracking the LOC for G/S intercept. capture G/S using HUD or PFD.		Evaluation Basis: Evaluate handling qualities in landing. For desired performance, there should be no tendency to PIO or bobble in pitch or roll. There should also be no tendency to float or bounce after touchdown. There should be no geometry strikes on touchdown.	ired perfor endency to	mance, there she float or bounce	ould be no after
ottles a	t 50 ft AGL.				Performance Standards Target	get	Desired	Adequate
30 g 31	crao and mar	e maneuver to n	ute a uectao and mare marcuver to touchdown at the target point. Max	мах			±5	01∓
iate a f	orward slip (1	max bank angle	. 5 deg).				£	9∓
ottles a	1 50 ft AGL.	ottles at 50 ft AGL.			Longitudinal distance from threshold at touchdown (ft)   1250	0,	1000-1500	750-2250
onchdo	wn at the targ	get point on the	suchdown at the target point on the runway. Max bank angle is 5 deg.	i deg.	Lateral offset from runway centerline at touchdown (ft)   0		∓10	±27
to idle	and lower th	to idle and lower the nosewheel to the runway.		ı	Sink Rate at touchdown (fusec)		54	15
2		Í			) ft AGL (deg)	Н	±5	£4
Š	of Not Flying (PNF);	NF):				0]	No PIO	Not Divergent
Tou Vine	F	11 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	and the second s	1	Geometry Strikes (tail, engine nacelle, wing tip) No Strikes	rikes	No Strikes	No Strikes

26-Nov-96 DLR

Date:

Runs:

Pilot:

Approach and Landing with Jammed Control

Fligh	it Phase	<b>P</b>	MTE	Weather State	State	Failures
ISA. Initial	Approach Fix	d Approach Fix 313. Complete Approach and Landing	ete Approach	1.	23.	Stabilizer Jam
Loading:	7. MFC - Fins	oading:   7. MFC - Final Cruise condition	tion			
Head/X	Turb/	Approach	Ceiling/	Rwy		
Wind, kt		Category	Visibility	Surface	Initial	Initial Position
0 KV	Light	0	Unlimited/	Dry,	3 nm outside	nm outside OM; On LOC
0 Kt	None		Unlimited	grooved		

Loading: 7. MFC - Final Cruise condition   Head/X	Celling/Visibility Unlimited Unlimited Unlimited HUD HUD	Rwy Surface Dry, grooved Ab L Jam ON ON ON OFF	aro.  Initial Position 3 nm outside OM; On LOC Abnormals/Exceptions: Jammed Stabilizer
	7. MFC - Final Cruise conditions for the condition of the	and Landing	elling/ Rwy limited Dry. limited Dry. limited Brooved A.S. NORMAL A.A.S. NORMAL A.B. NORMAL A.

- Procedure—Evaluation Pilot (PF):

  1. Establish aircraft in steady level flight at the noted conditions, tracking the LOC.

  2. Slow to Vapp prior to intercepting glideslope.

  3. Capture G/S. Track LOC and G/S using raw ILS on HUD or PFD.

  4. Disconnect autorhortles at 50 ft AGL.

  5. Manually retard throttles and execute a flare to touchdown at the target point on the runway.

  6. After touchdown, retard throttles to idle and lower the nosewheel to the runway.

- Procedure—Test Engineer / Pilot Not Flying (PNF):

  1. Confirm initial conditions.

  2. Set Vapp as commanded speed at DME 7.0

  3. 1/2 dot before G/S capture, call "Gear Down" and move gear handle to the down position

Start Evaluation:			
End Evaluation: 200 ft AGL, Landing Speed, Descending	Level scending		
Evaluation Basis: Evaluate the ability to accurately maneuver onto the final approach path and maintain nominal approach profile and speed at low altitudes. Attained trimmed flight before the middle marker (approximately 0.5 nm from the end of the runway).	uver onto the fin ed trimmed flight	al approach path a I before the middle	und maintain marker
Performance Standards	Target	Desired	Adequate
Deviation from Final Approach Airspeed (kt)	0	£	01 <del>1</del>
Deviation from Glideslope (dots)	0	±0.3	£1.0
Deviation from Localizer (dots)	0	±0.5	₹1.0
Evaluation Segment: Precision Landing		Lone CHR	II.at / Dir CHR
Start Evaluation: 200 ft AGL, Landing Speed, Descending End Evaluation: Nosewheel touchdown	scending		
Evaluation Basis: Evaluate handling qualities in landing. For desired performance, there should be no tendency to PIO or bobble in pitch or roll. There should also be no tendency to float or bounce after touchdown. There should be no geometry strikes on touchdown.	For desired pert o be no tendency lown.	formance, there sh	ould be no
Performance Standards	Target	Desired	Adequate
Deviation from Approach Airspeed at 50 ft (kt)	0	£\$	01 <del>1</del>
Deviation from Runway Heading at touchdown (deg)	0	₹3	9‡
Longitudinal distance from threshold at touchdown (ft)	1250	1000-1500	750-2250
Lateral offset from runway centerline at touchdown (ft)	0	∓10	±27
Sink Rate at touchdown (fl/sec)	<b>&gt;</b>	\$4	15
Maximum Bank Angle below 50 ft AGL (deg)	0	<del>‡</del> 2	ĹŦ
Pilot Induced Oscillations (PIO)	No PIO	No PIO	Not Divergent
Geometry Strikes (tail, engine nacelle, wing (to)	No Strikes	No Strikes	No Strikes

Runs:

Pilot:

Circling Approach & Landing

4140

	Phase	<b>P</b>	VITE	Weather State	State	Failires
	-	315. Circli	Annroach	72. Maroinal+	VER 34	72 Marcinal+ VFR . 34 (0. No Failures
Approach Fix	χį			Kı	3	
oading:	<b>P</b> 1	7. MFC - Final Cruise condition	tion			
Head/X	Turb/	Approach	Celling/	Rwy		
Wind, kt	Gusts	Category	Visibility	Surface		Initial Position
0 KU	Moderate/	٥	1000/	Dry,	Г	/2 mi. outside OM, at 1,500 ft AGL
35 Kt	None		7 nm	grooved		

	Abnormals/Exceptions:	None				
Ä				Z O		Ref H Cyc 3
	PSCAS	RSCAS	A/T	HUD	F/D	Config
			159			
			Vg/a			
	1,500	159	384,862	53.2	DOWN	Auto
	ALT	KEAS/M	ĕ	S. G.	GEAR	LEF/TEF

Note: DME 2.6: Hdg 045; DME 2.6: Hdg 360; DME 3.6: Hdg 260

Procedure–Evaluation Pilot (PF):

1. Maintain G/S and LOC on descent to DEN runway 35R.

2. Upon breakout begin VFR circling approach for line-up with runway 26. Observe minimum altitude of 750 if and maximum bank angle of 30 deg. prior to completion of final turn. See heading vs. DME table in NOTE above.

3. Disconnect autochrottles at 50 ft AGL.

4. Manually retard throttles and execute a flare to touchdown at the target point on the runway.

5. After touchdown, retard throttles to idle and lower the nosewheel to the runway.

Procedure—Test Engineer / Pilot Not Flying (PNF):

1. Confirm initial conditions.
2. During approach, PNF monitors any performance indicators that will not be automatically reported at the end of the run.
3. Upon breaking out of clouds, call "Runway in sight".

Evaluation Segment: Circling Approach	Circling Approach		Long CHR   Lat / Dir CHR	Lat / Dir CHR
Start Evaluation: End Evaluation:	1,500 ft, Final Approach Speed, on G/S 200 ft AGL, Landing Speed, Descending	1, on G/S escending		
Evaluation Basis: Evaluate the the terminal area at low altitude.	Evaluation Basis: Evaluate the ability to rapidly maneuver onto alternate runway using VFR techniques in the terminal area at low altitude.	er onto alternate i	unway using VFR	techniques in
Performs	Performance Standards	Target	Desired	Adequate
Dev. from Final Appr. Airspeed (KEAS)	rspeed (KEAS)	Vapp	\$ <b>∓</b>	01∓
Minimum altitude prior to	dinimum altitude prior to initiation of final turn (ft)	750 AGL	750 AGL	650 AGL
Maximum bank angle dur	Maximum bank angle during circling approach (deg)		∓30	±45

Evaluation Segment: Precision Landing	Precision Landing		Long CHR	Long CHR Lat / Dir CHR
Start Evaluation: End Evaluation:	200 ft AGL, Landing Speed, Descending Nosewheel touchdown	escending		
Evaluation Basis: Evalu tendency to PIO or bobbi touchdown. There should	Evaluation Basis: Evaluate handling qualities in landing. For desired performance, there should be no tendency to PIO or bobble in pitch or roll. There should also be no tendency to float or bounce after touchdown. There should be no geometry strikes on touchdown.	3. For desired perfiso be no tendency adown.	ormance, there sh to float or bounce	ould be no after
Performs	Performance Standards	Target	Desired	Adequate
Deviation from Approach Airspeed at 50 ft (kt)	Airspeed at 50 ft (kt)	0	<del>‡</del> \$	±10
Deviation from Runway	Deviation from Runway Heading at touchdown (deg)	0	#3	9∓
Longitudinal distance fro	ongitudinal distance from threshold at touchdown (ft)	1250	1000-1500	750-2250
Lateral offset from runwa	ateral offset from runway centerline at touchdown (ft)	0	∓10	±27
Sink Rate at touchdown (fusec)	(fúsec)	>	54	23
Maximum Bank Angle below 50 ft AGL (deg)	elow 50 ft AGL (deg)	0	∓\$	17
Pilot Induced Oscillations (PIO)	s (PIO)	OId oN	No PIO	Not Divergent
Geometry Strikes (tail, engine nacelle, wing tip)	ngine nacelle, wing tip)	No Strikes	No Strikes	No Strikes

18-Dec-96 DLR

Runs:

Pilot:

Date:

Decelerating Approach & Landing

4220

Fig	nt Phase		MTR	Westher State	State	Polimboo	_	100
					1	T. WILLIAM	_	
15B. Mane	Maneuver to Final		1313. Complete Approach	1. Light Turb.		0. No Failures	_	100
Approach Fix	Ϋ́							
Loading:	ig: 17. MFC - Final Cruise condition	d Cruise condi	tion					5
		F					_	
Head/A	Tarb/	Approach	_	Kwy			_	N.
Wind, kt	Gusts	Category	Visibility	Surface	I	Initial Position		A II
0 KV	Light	0	Unlimited	D 24.	1/2 nm c	nm outside OM, on LOC		
0 80	None		Unlimited	prooved				١

A THE CHARGE CIAL, OF LA	Abnormals/Exceptions: None.	
<b>7</b> 2		
grooved	185 PSCAS NORMAL 159 RSCAS NORMAL 154 A/T ON 159 HUD ON 125 FUD OFF 125 Confis Ref H Cv. 3	
ğ	22	
Unlimited	PSCAS RSCAS A/T HUD F/D	
,	183 159 154 159 125	
	Vappl Vapp2 Vref Vg/a Vmin	
None	1,500 185 185 384,862 53.2 DOWN	
0 Kt	ALT 1.500 Vappl KEAS/M 185 Vapp2 GW 384.862 Vref C.G. 53.2 Vg/a GEAR DOWN LEF/TEF Auto	
_		

- Procedure—Evaluation Pilot (PF):

  1. Establish aircraft in steady level flight at the noted conditions.

  2. Track LOC to G/S intercept and capture G/S.

  3. Auto-flap decel schedule will initiate at 750 ft AGL. Allow airspeed to decay to Vapp2 at threshold crossing.

  4. Disconnect autothrottles at 50 ft. Manually retard throttles and execute a flare to touchdown at the target point on the runway.

  5. After touchdown, retard throttles to idle and lower the nosewheel to the runway.

Procedure-Test Engineer / Pilot Not Flying (PNF):

1. Confirm initial conditions. Initial speed should be Vapp1, with auto-flap decel schedule armed.

2. 1/2 dot before G/S capture, call out "Gear Down" and move gear handle to the down position

	Level cending onto the final a	pproach path at lo m the end of the r	ow altitudes. unway).
End Evaluation: 200 ft AGL, Landing Speed, Descending	onto the final a	pproach path at lo m the end of the r Desired	ow altitudes. unway).
Evaluation Basis: Evaluate the ability to rapidly maneuver onto the final approach path at low altitudes. Attained trimmed flight before the middle marker (approximately 0.5 nm from the end of the runway).	ately 0.5 nm fro	Desired	
Performance Standards	Target		Adequate
Dev. from Final Appr. Airspeed (KEAS)	Vapp	££	01 <del>T</del>
Deviation from Glideslope (dots)	0	±0.5	0.1±
Deviation from Localizer (dots)	0	±0.5	€1.0
Evaluation Segment: Precision Landing		Long CHR	Long CHR Lat / Dir CHR
Start Evaluation: 200 ft AGL, Landing Speed, Descending End Evaluation: Nosewheel touchdown	ending		
Evaluation Basis: Evaluate handling qualities in landing. For desired performance, there should be no tendency to PIO or bobble in pitch or roll. There should also be no tendency to float or bounce after touchdown. There should be no geometry strikes on touchdown.	or desired perfore be no tendency own.	ormance, there sh to float or bounce	ould be no after
Performance Standards	Target	Desired	Adequate
Deviation from Approach Airspeed at 50 ft (kt)	0	₹	01∓
Deviation from Runway Heading at touchdown (deg)	0	±3	9∓
Longitudinal distance from threshold at touchdown (ft)	1250	1000-1500	750-2250
Lateral offset from runway centerline at touchdown (ft)	0	∓10	±27
Sink Rate at touchdown (ft/sec)	<b> </b>	<b>S4</b>	<i>L</i> S
Maximum Bank Angle below 50 ft AGL (deg)	0	#\$	£
Pilot Induced Oscillations (PIO)	No PIO	No PIO	Not Divergent
Ceometry Strikes (tail, engine nacelle, wing tin)	No Contract	No Contrac	k

Lat / Dir CHR

Long CHR

Runs:

Adequate

Desired

Target

Performance Standards

Dev. from Final Appr. Airspeed (KEAS)
Deviation from Glideslope (dots)

Deviation from Localizer (dots)

Vapp

Evaluation Basis: Evaluate the ability to rapidly maneuver onto the final approach path at low altitudes. Attained trimmed flight before the middle marker (approximately 0.5 nm from the end of the runway).

200 ft AGL, Landing Speed, Descending 1,500 ft, Final Approach Speed, Level

Glideslope Intercept

Evaluation Segment: Start Evaluation:

and Evaluation:

Pilot:

0.11

# Decel. Approach & Landing - Manual Throttles

4225

Filgi	nt Phase	M	MTE	Weather State	State	Failures
15B. Maneuv Approach Fix	Maneuver to Final ach Fix	313. Comple and Landing	313. Complete Approach and Landing	1. Light Turb.		0. No Failures
Loading:	7. MFC - Fina	. MFC - Final Cruise condition	tion			
Head/X	Turb/	Approach	Ceiling/	Rwy		
Wind, kt	Gusts	Category	Visibility	Surface	I	Initial Position
0 KV	Light	0	Unlimited/	Dry,	1/2 nm	nm outside OM, on LOC.
0 Kt	None		Unlimited	grooved		

	Initial Posi	I/2 nm outside OM,	Abnormals/Exceptions:	None				
	Rwy Surface	Dry, grooved	_			N O	田	Cyc 3
	Ceiling/ Visibility	Unlimited/ Unlimited	185 PSCAS NO	_	A/T	HUD	F/D	Config Ref H Cyc 3
THE CHICAGON	Approach Category	0	1			Vg/a 159		
	Turb/ Gusts	Light/ None	1,500 Va		GW 384,862		NMOG	Auto
	Head/X Wind, kt	0 KV 0 Kt	ALT	KEAS/M	ĕ S	ပ	GEAR	LEF/TEF

## Procedure-Evaluation Pilot (PF)

- Establish aircraft in steady level flight at the noted conditions, maintaining Vapp1.

  Track LOC to G/S intercept and capture G/S. At 1400 ft, set throttles to 9%.

  Track G/S and maintain throttle setting of 9%. Auto-flap decel schedule will initiate at 750 ft AGL. Allow airspeed to decay to Vapp2 at threshold crossing.

  Execute a flare to touchdown at the target point on the runway.

  After touchdown, retard throttles to idle and lower the nosewheel to the runway. -.46

Procedure—Test Engineer / Pilot Not Flying (PNF):

1. Confirm initial conditions. Initial speed should be Vapp1, with auto-flap decel schedule armed.

2. 1/2 dot before G/S capture, call out "Gear Down" and move gear handle to the down position

61

## Lat / Dir CHR Not Divergent No Strikes ±6 730-2250 Evaluation Basis: Evaluate handling qualities in landing. For desired performance, there should be no tendency to PIO or bobble in pitch or roll. There should also be no tendency to float or bounce after touchdown. There should be no geometry strikes on touchdown. £1.√2 Long CHR ±3 ±3 1000-1500 No Strikes Desired 44 ±5 No PIO No Strikes Target 1250 200 ft AGL, Landing Speed, Descending Deviation from Approach Airspeed at 30 ft (kt) Deviation from Runway Heading at touchdown (deg) Longitudinal distance from threshold at touchdown (ft) Lateral offset from runway centerline at touchdown (ft) Sink Rate at touchdown (ft/sec) Maximum Bank Angle below 50 ft AGL (deg) Pilot Induced Oscillations (PIO) Geometry Strikes (tail, engine nacelle, wing it) Nosewheel touchdown Evaluation Segment: Precision Landing Performance Standards tart Evaluation: End Evaluation:

Stall at Idle Power

Long CHR Lat / Dir CHR

Steady flight, wings level Wings level at recovered angle of attack

Runs:

Pilot:

Date:

3-Dec-96 LJG

Evaluation Segment: Seell	Start Evaluation: Steady fl	Cnd Evaluation: Wings le	Ollipio	PIO. Recovery never in question.
Failures	0. No Failures		Initial Position	ΝΆ
Weather State	-		Rwy	Dry, grooved
MTE	l at Idle Power	ondition	Approach Ceiling/ Rwy Category Visibility Surface	Unlimited Unlimited
lse l	A. Descent into Class B 400. Stall at Idle Power ispace	ding: 7. MFC - Final Cruise condition	Turb/ Approac Gusts Categor	Light/ 0 None
Flight Ph	13A. Descent into Airspace	Loading: 7. M	X kt	0 Kr 0 Kr

	Taitelal Darleta	MA WA		Abnormals/Exceptions:	None				
	Rwy Curfoco	Dry,	grooved	NORMAL A		_	Z	OFF	1 Cyc 3
ition	Ceiling/	Unlimited	Unlimited	Idle PSCAS NO	RSCAS NC	A/T	HUD	FD	Config Ref H Cyc 3
d Cruise cond	Approach	0		EPR Idle	Trim	155			
Loading: 7. MFC - Final Cruise condition	Turb/ Guete	Light	None	10,000	155	84,862	53.2	ď	Auto
Loading:	Head/X Wind kt	0 Kv	0 Kt	ALT	KEAS/M	38	C.G.	GEAR	LEF/TEF

Procedure-Eva
1. Establish strai
2. Using pitch in second
3. Decelerate to recovery, 1. At recovery, 1. 5. Terminate the steady). No th

Procedure-Test
1. Confirm initia
2. Monitor decel
2. Monitor decel
3. Call our reco
4. Verify flaps re
5. Terministe massteady).

			ŀ		condition	_
Gusts	Approaca Category	Visibility	Kwy Surface	Initial Position	Desired and an inches	Т
Light/ None	0	Unlimited Unlimited	Dry, grooved	WA	PIO. Recovery never in question.	
					Performance Standards Taroot Decired Administra	Т
L		PSCAS	Ξ	Abnormals/Exceptions:	0	T
4,862 V8 53.2 V8	WC Inm Vapp 155	RSCAS NOR A/T HUD		None.	O	
Auto		RefH	2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3			
raight descer inputs to cor	valuation Pilot (PF): aight descending flight at inputs to control flight pa	Vapp on a cardinal the angle, establish an	heading wi nd maintair	valuation Pilot (PF); sught descending flight at Vapp on a cardinal heading with idle thrust. inputs to control flight path angle, establish and maintain a smooth deceleration of 1 knot per		
o an airspee	1 which prod	uces approximately 2	21 degrees	o an airspeed which produces approximately 21 degrees angle-of-attack before initiating		
, lower the n he maneuver throttle adju	, lower the nose and maintain wir he maneuver when recovery is as throttle adjustments are allowed.	lower the nose and maintain wings-level. he maneuver when recovery is assured (i.e. wi throttle adjustments are allowed.	ings level v	, lower the nose and maintain wings-level. he maneuver when recovery is assured (i.e. wings level with AOA less than 13 degrees and throttle adjustments are allowed.		
est Engine tial condition releration and	er / Pilot P 1S. I call out dev	ist Engineer / Pilot Not Flying (PNF): tial conditions. eleration and call out deviations from the targe	: et rate. Veri	sst Engineer / Pilot Not Flying (PNF): tial conditions. exercision and call out deviations from the target rate. Verify flaps are automatically extending on		
cover" when angle-of-att retract during recovery. naneuver when recovery	angle-of-atta ig recovery. en recovery i	cover" when angle-of-attack reaches 21 degrees. retract during recovery.	æs. s level with	cover" when angle-of-attack reaches 21 degrees. retract during recovery. assured (i.e. wings level with AOA less than 13 degrees and naneuver when recovery is assured (i.e. wings level with AOA less than 13 degrees and		
			,			
			ĺ			İ
						1
						1
					To the designation of the second seco	1

Long CHR Lat / Dir CHR

Runs:

Pilot:

Stall at Max Takeoff Power

Long CHR   Lat / Dir CHI			as alementar learners on History	igui oi sain. 140 condoi reversans of
Stall	Steady flight, wings level	wings level at recovered angle of attack condition	Example Basis: Manuever rossible without excentional milotine etraneth or skill No control encented or	prestion.
Evaluation Segment: Stall	Start Evaluation:	TAN EVENOR.	Evaluation Bacis: Manu	PIO. Recovery never in question.
				_,
Failures	0. No Failures	artial wing fuel, max payload	Initial Position	N/A
Weather State	I. Light Turb.	i fuselage fuel, p	Rwy Surface	Dry, grooved
MTE	401. Stall at Max. Takeoff 1. Power	i. M13 - Max Taxi Weight @ fwd C.G., full af	Ceiling/ Visibility	Unlimited/ Unlimited
		lax Taxi Weigh	Approach Category	0
ght Phase	<ol> <li>Class B Airspace limb</li> </ol>	3. M13 - M	Turb/	Light/ None
FIII	3B. Class Climb	Loading	Head/X Wind, k(	0 KU 0 Kt

Abnormals/Exceptions:	None				
NORMAL					Config Ref H Cyc 3
PSCAS	RSCAS	A/T	HUD	F/D	Config
MID	Trim				
EPR	R/C				
10,000	186	/ 649,914	48.1	UP	Auto
ALT	KEAS/M	8	S. S.	GEAR	LEF/TEF

- 63

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خ	er when recovery is	
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4. veniy naps retract	Ś	

Standards Target Desired Adequate 0 ±5 ±10 0 No PIO No PIO Not Divergent						
Performance Standards Maximum bank angle (deg.) Filot Induced Oscillations (PIO)			-			
ALT 10,000 EPR MIO PSCAS NORMAL   REASIM 186 R/C Trim RSCAS NORMAL GW 649,914 A/T OFF C.G. 48.1 HUD OFF CEAR UP ROLL   CONFIGURATION   CONFI	Evaluation Pilot (PF): straight climbing flight on a cit inputs to control flight pall to an airspeed which producery, lower the nose and maint to the maneuver when recover No throttle adjustments are all	Procedure—Test Engineer / Pilot Not Flying (PNF):  1. Confirm initial conditions.  2. Monitor deceleration and call out deviations from the target rate. Verify flaps are automatically extending on schedule.  3. Call out "recover" when angle-of-attack reaches 21 degrees.  4. Verify flaps retract during recovery.  5. Terminale maneuver when recovery is assured (i.e. wings level with AOA less than 13 degrees and steady).				

3-Dec-96 DWD

\_ Runs:\_

Pilot:

Date:

Turning Stall at Idle Power

Flig	light Phase	W	MTE	Weather State	State	Failures
A. Desc	Descent into Class B 403. Turning Stall at Idle	403. Turning	s Stall at Idle	1. Light Turb.		0. No Failures
irspace		power		,		
ading:	7. MFC - Fina	MFC - Final Cruise condition	tion			
lead/X	Turb/	Approach	Celling/	Rwy		
Vind, kt	Gusts	Category	Visibility	Surface	_	Initial Position
0 KV	Light	0	Unlimited	Dry,		W.A
) Kt	None		Unlimited	grooved		

Initial Position		Abnormals/Exceptions: None.
Rwy Surface	Dry, grooved	NORMAL NORMAL OFF ON OF ON OFF
Celling/ Visibility	Unlimited/ Unlimited	Idle PSCAS NG 155 AT 155 AT 157 HUD F/D Config Ref 1
Approach Category	0	EPR Idle R/C Trim Vapp 155
Turb/ Gusts	Light/ None	10,000 155 184,862 53.2 UP Auto
Head/X Wind, kt	0 Kv 0 Kt	KEAS/M GW 3 C.G. GEAR LEF/TEF

- Procedure1. Establish
  2. Using pit
  second.
  3. Deceleral
  recovery.
  4. Lower th
  5. Terminat
  steady). N

- Procedure—
  1. Confirm i
  2. Monitor d
  3. Call out i
  4. Verify fla
  5. Terminate
  steady).

Long CHR Lat / Dir CHR	Wings level at recovered angle of attack	Evaluation Basis: Manuever possible without exceptional piloting strength or skill. No control reversals or		No PlO No PlO Not Divergent					
	End Evaluation: Wings level at recov		Derformance Contact	Wings level bank angle (deg) Flot Induced Oscillations (P(O)	knot per ing	rtending on			
Weather State Failur  1. Light Turb. 6. No Failures		Rwy Surface Initial Position Dry.	grooved	NORMAL None. NORMAL None. OFF ON OFF	and maintain a smooth deceleration of 1 knot pr 721 degrees angle-of-attack before initiating very is assured. Wings level with AOA less than 13 degrees and	?): rget rate. Venify flaps are automatically ex rees. gs level with AOA less than 13 degrees a			
MTE urning Stall at Idle	Final Cruise conditi	Approach Ceiling/ S Category Visibility  0 Unlimited	$\dashv$	10,000   EPR   Idle   PSCAS   NORI   155   R/C   Trim   RSCAS   NORI   83.2   A/T   HUD   F/D   F/D   F/D   F/D   Auto   Config Ref H C	-Evaluation Pilot (PF): ha descending 30-degree banked turn. itch inputs to control flight path angle, establish and maintain a smooth deceleration of 1 knot per ate to an airspeed which produces approximately 21 degrees angle-of-attack before initiating y, he nose and roll wings-level until positive recovery is assured. The maneuver when recovery is assured (i.e. wings level with AOA less than 13 degrees and No throttle adjustments are allowed.	-Test Engineer / Pilot Not Flying (PNF): initial conditions. initial conditions. deceleration and call out deviations from the target rate. Verify flaps are automatically extending on e. "recover" when angle-of-attack reaches 21 degrees. Instruct during recovery. Itemaneuver when recovery is assured (i.e. wings level with AOA less than 13 degrees and			milities of subsequences and the subsequences of the subsequences

3-Dec-96 LJG

Date:

Runs:

Pilot:

Not Divergent

Desired ±5 No PIO

Target No PIO

Wings level bank angle (deg) Pilot Induced Oscillations (PIO)

Turning Stall at Thrust for Level Flight

Long CHR   Lat / Dir CHR				oth or chill No control reversals or	ight of shift, the colline revelsats of	Target Desired Adequate	¥ 7 7
		le ot attack		onal nilotino etren	name Sumound muso	Target	ķ
Evaluation Segment: Turning Stall		whiles level at recovered angle of anack		Evaluation Basis: Manuever mossible without excentional milating strength as ekill Na control response to	PIO. Recovery never in question.	Performance Standards	Wings level hank angle (dog)
Evaluat	Start Evaluation:			Evaluati	PIO. Rec		Wings
Failures	0. No Failures			Initial Position	N/A		lc/Fycentions
Veather State	t Turb.		γ,	I I	,,		Abnormale/F
M	h 1. Ligh		g/ Rw	ity Surf	d Dry		NORMAL
MTE	404. Turning Stall wit Thrust for Level Flight	dition	Ceillin	Visibil	Unlimited Unlimited		S V J Sd
	Hole. Turn Thrust for	Final Cruise condition	Approach	Category	0		KPR Tam DSCA
Phase	nt into Class B 4	7. MFC - Fin	Turb/	Gusts	Light/ None		10.0001
Flight	13A. Descer Airspace	Loading:	Head/X	Wind, kt	0 Kt/ 0 Kt		AT.T.

and the second	Initial Position	N/A	Abnormals/Exceptions: Nonc.
	Rwy Surface	Dry, grooved	
tion	Celling/ Visibility	Unlimited/ Unlimited	[ ~
Loading: [ 7. MFC - Final Cruise condition	Approach Category	0	EPR Trim PSCAS R/C 0 RSCAS Vapp 155 A/T HUD F/D
7. MFC - Fi	Turb/ Gusts	Light/ None	10,000 155 84,862 53.2 UP Auto
Loading:	Head/X Wind, kt	0 Kt/ 0 Kt	KEAS/M GW 3 C.G. GEAR LEF/TEF

- Procedure—Evaluation Pilot (PF):

  1. Establish a descending 30-degree banked turn.

  2. Using pitch inputs to control flight path angle, establish and maintain a smooth deceleration of 1 knot per
  - second.

    Decelerate to an airspeed which produces approximately 21 degrees angle-of-attack before initiating. ۳.
- recovery.

  4. Lower the nose and roll wings-level until positive recovery is assured.

  5. Terminate the maneuver when recovery is assured (i.e. wings level with AOA less than 13 degrees and steady). No throttle adjustments are allowed.

- Procedure—Test Engineer / Pilot Not Flying (PNF):

  1. Confirm initial conditions.
  2. Monitor deceleration and call out deviations from the target rate. Verify flaps are automatically extending on schedule.
  3. Call out 'recover" when angle-of-attack reaches 21 degrees.
  4. Verify flaps retact during recovers.
  5. Terminate manniture when processes is a contract that the processes is a contract th

overy is assured (i.e. whigs revel with AOA less than 15 degrees and		
leady).		5. Terminate maneuver when recovery is assured (i.e. wings fever with ACA less than 15 degrees and steady).

24-Oct-96 EBJ

Date:

Long CHR | Lat / Dir CHR

Runs:

Pilot:

**Diving Pull-out** 

5060

100 100 100 100 100 100 100 100 100 100	LOUIS CHR LAIT DIE CH				in the second se	gui of saint, and without exceeding	
Evaluation Seement: District Della	Thring rullour	Straight and Level Flight (Cruise)	Straight Flight at Initial Spend	Daniel Ingili de minista Dicea	Janenver nossible without exceptional piloting steems	VD/MD. No control reversals or PIO.	
Evaluation Seeme		Start Evaluation:	End Evaluation:		Evaluation Basis: N	VD/MD. No control	
_		_					_
State Failures	Ī	o. 190 ratidics	.c.		Initial Position	NA NA	
Weather	1 johr Turk	1010	plus tuel for art	Rwy	Surface	Dry.	grooved
TTE	Pull-out		III DOING, M.Z.F.W	Ceiling/	Visibility	Unlimited	Unlimited
	408 Divina		a Cruise desig	Approach	Category	0	
nt Phase	ionic Cruise	17.1	C. MCR - MIK	Turb/	Gusts	Light/	None
Flig	7B. Supers		LORUINE:	Head/X	Wind, kt	O.K.V	O.K.

Abnormals/Exceptions: None.
NORMAL NORMAL OFF ON OFF
RSCAS RSCAS A/T HUD F/D Config
R/C (
64,000 M 2.4 S01,324 54.8 UP Auto
ALT KEAS/M GW C.G. GEAR EF/TEF

Procedure-Evaluation Pilot (PF):

1. Establish straight and level flight on a cardinal heading at the specified airspeed.

2. Establish a -7.5 degree flight path for 20 seconds or until 2.5 M is reached.

3. Execute a 1.5g pullup. Retard throttles to idle.

4. Return to flight within Vmo/Mmo limits. Do not adjust throttle.

Procedure—Test Engineer / Pilot Not Flying (PNF):

1. Confirm initial conditions.

2. After descent begins, monitor flight path angle to ensure a -7.5 degree descent.

3. Call "recover" at either M 2.5 or 20 seconds, whichever is first reached.

4. Monitor load factor during recovery and provide feedback to PF if necessary to ensure a smooth 1.5g recovery.

Adequate Desired Target Performance Standards Maximum Bank Angle (deg) Maximum load factor during recovery (g)

				090
				5060

Date:

Long CHR | Lat / Dir CHR

Straight and level flight (cruise) Straight and level flight (low altitude)

Evaluation Segment: Emergency Descent

Start Evaluation: End Evaluation:

Pllot:

Runs:

**Emergency Descent** 

5070

Fligi	nt Phase	W	MTE	Weather	State	Failures
7A. Supers	sonic Cruise	411. Emerge	ency Descent	1. Light Turb.		0. No Failures
Loading:	11. MIF - H	MIF - Heavy, Fwd C.G. Limi	. Limit			
Head/X	Turb/	Approach	Ceiling/	Rwy		
Wind, kt	Gusts	Category	Visibility	Surface	=	Initial Position
0 Kt/	Light	0	Unlimited	Dry.		N/A
0 Kt	None		Unlimited	grooved		

Failures	0. No Failures			Initial Position	N/Α		Exceptions:	Engine Inlets intentionally unstarted during	6			
Weather State	Furb.						Abnormals/Exceptions:	Engine Inlets		recovery.		
Wea	1. Light		Rwy	Surface	Dry,	grooved	ORMAL	NORMAL	OFF.	Ö	<u> </u>	H Cvc 3
MTE	411. Emergency Descent   1. Light Turb.	J. Limit	Ceiling/	Visibility	Unlimited	Unlimited	O PSCAS NORMAL	RSCAS N	Α⁄Τ	HUD	F/D	Config Ref H Cvc 3
	411. Emerg	Loading: 11. MIF - Heavy, Fwd C.G. Limit	Approach	Category	0		R/C 0					
Flight Phase	7A. Supersonic Cruise	11. MIF - F	Turb/	Gusts	Light/	None	ALT 55,400	M 2.4	GW 614,864	47.2	ďD	Auto
Fligh	7A. Supers	Loading:	Head/X	Wind, kt	0 Kt/	0 Kt	ALT	KEAS/M	<b>₹</b>	၁	GEAR	LEF/TEF

- Procedure-Evaluation Pilot (PF):
   Establish straight and level flight at noted airspeed on a cardinal heading.
   When cabin depressurization is detected, wait 17 seconds, then initiate emergency descent: throttles to idle, drag devices deployed, 45° bank angle. Do not exceed load factor and Vmo limits.
   Return to level flight at 15,000 ft.

Procedure—Test Engineer / Pilot Not Flying (PNF):
1. Confirm initial conditions.
2. Monitor descent profile and call envelope excursions.
3. Call out altitudes every 5,000 ft.
4. Call out altitude when passing through 16,000 ft.

	 Evaluation Basis: Evaluate handling qualities during a rapid, maximum speed descent from cruise. Perform maneuver smoothly, with no tendency to oscillate or hunt for pitch attitude or speed throughout the maneuver.	apid, maximum s for pitch attitude o	peed descent from or speed throughou	cruise. Perform at the maneuver.
	 Performance Standards	Target	Desired	Adequate
	 Normal Acceleration (g)		1.0±0.5	0/+2.0
rted during	 Airspeed above Vmo (kt)	0	0	25

6	7

21-Oct-96 EBJ

Date:

Long CHR Lat / Dir CHR

Runs:

Pilot:

Inadvertent Speed Increase

6050

Flig	nt Phase	MTE	TE	Weather State	Pailures	Evaluation Seement:	Evaluation Segment: Inclusion Seed Increase Chick canad
7C. Supera	sonic Cruise	504. Inadver Increase, Hig	nadvertent Speed se, High Speed	nadvertent Speed 1. Light Turb.	0. No Failures	Start Evaluation:	Straight and Level Flight (Cruise)
Loading:	7. MFC - Fins	al Cruise condition	tion			end Evaluation:	Straight and Level Flight
Head/X Wind. kt	Turb/ Gusts	Approach	roach Celling/	Rwy	Initial Doction	Evaluation Basis: Mane	Evaluation Basis: Maneuver is possible without exceptional piloting
0 KV	Light	0	Unlimited	Dry,	WA	g. Maga	
0 Kt	None		Unlimited grooved	grooved		Perform	Performance Standards

		Initial Position	NA	Abnormals/Exceptions: Nonc.
		Rwy Surface	Dry, grooved	
sh Speed	tion	Ceiling/ Visibility	Unlimited/ Unlimited	O PSCAS NORMAL A/T OFF A/T OFF HUD OFF Config RefH Cyc 3
Increase, High Speed	Loading: 7. MFC - Final Cruise condition	Approach Category	0	R/C 0
	7. MFC - Fin	Turb/ Gusts	Light/ None	<b>[</b> ]
	Loading:	Head/X Wind, kt	0 KU 0 Kt	ALT 64,000 KEAS/M M.2.4 GW 384,862 C.G. 53.2 GEAR UP LEF/TEF Auto

Procedure-Evaluation Pilot (PF):
1. Establish straight and level flight at M 2.4.
2. Push over to 0.7g load factor for 5 seconds.
3. Initiate a 1.5 g pullup recovery to level flight.
4. Terminate maneuver when level flight has been established.

Procedure-Test Engineer / Pilot Not Flying (PNF):
1. Confirm initial conditions.
2. Monitor load factor and call out when deviations exceed 0.1 g from target.

Performance Standards	Target	Desired	Adequate
laximum Bank Angle (deg)	0	£	<u>e</u> #
Maximum load factor during recovery (g)	5.7	1.5±0.2	1.5±0.5
Maximum Mach	<2.6	<2.6	<2.6

Long CHR Lat / Dir CHR

Straight and Level Flight (Cruise) Straight Flight

2-axis Upset

Runs:

Pilot:

9090

2-Axis Upset

Evaluation Segment:	Start Evaluation:	The Common.	Evaluation Basis: Mane	- Md		Performs
Failures	0. No Failures			Initial Position	NA	
Weather State	1. Light Turb.		Rwy		Dry,	grooved
MTE	505. Simulated 2-Axis Gust Upset, High Speed	ndition			Unlimited/	Unlimited
		al Cruise co	Approach	Categor	0	
light Phase	7C. Supersonic Cruise	7. MFC - Final Cruise condition	, Larb		Light/	None
Fligh	7C. Supers	Loading:	Head/X	Wind, kt	0 Kv	0 Ki

			Initial Position	ΨN		Abnormals/Exceptions:	None				
		Rwy	Surface	Dry,	grooved		NORMAL		NO	OFF	1 Cyc 3
Gust Opset, mign speed	ition	Ceiling/	Visibility	Unlimited/	Unlimited			A/T	HUD	F/D	Config Ref H Cyc 3
Gust Opset,	.oading:   7. MFC - Final Cruise condition	Approach	Category	0		R/C 01					
	7. MFC - F	Turb/	Gusts	Light/	None	64,000]	M 2.4	384,862	53.2	I OP	Auto
	Loading:	Head/X	Wind, kt	0 Kt/	0 Kt	ALT	KEAS/M M 2.4	89	C.G.	GEAR	LEF/TEF

Procedure—Evaluation Pilot (PF):

1. Establish straight and level flight at M 2.4.

2. Reduce throttle to 50% and pull up gently to decelerate to M 2.3.

3. Establish a flight path angle of 6 degrees below the horizon, then roll to a bank angle of 15 degrees.

4. Maintain this attitude for 3 seconds.

5. Roll wings level.

6. Execute a 1.5 g pull-up to recover to level flight. Advance throttles to full to begin acceleration.

7. Terminate the maneuver after all transients have quiesed.

Procedure—Test Engineer / Pilot Not Flying (PNF):
1. Confirm initial conditions.
2. Count off 3 seconds after reaching M 2.4 and call out "Recover."
3. Monitor load factor during recovery and provide feedback to PF if necessary to ensure a smooth 1.5 g recovery. 0909

_	Performance Standards	Target	Desired	Adequate
_	Maximum Bank Angle (deg)	15	\$ <del>T</del>	01∓
_	Maximum load factor during recovery (g)	1.5	1.5±0.2	1.5±0.5

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VMCG

7030

26-Nov-96 LJG

60. Single Engine Failure Initial Position End of runway, on centerline. Failures Weather State 1. Light Turb. Loading: | 14. M3A - MZFW+Body Fuel+Win MITE Approach Category Turb/ Gusts Light Flight Phase Head/X Wind, kt OKy

02	Abnormals/Exceptions: No nosewheel cornering force above 80 knots. Fail #4 engine at Vmcg.	
ed grooved	NORMAL NORMAL OFF ON OFF	Config Ref H Cyc 3
Cimilinica	TBD PSCAS 127 RSCAS 139 A/T TBD HUD TBD F/D	Config
	852 85 BB	121
-	VI VI V2+10	
NO.	Field 384,862 54 DOWN	<u> </u>
	KEAS/M GW 38 C.G. GEAR D	LEF/1 EF

Procedure-Evaluation Pilot (PF):

- Set brakes.
   Advance throttles to takeoff EPR.
   Advance throttles and maintain centerline during ground roll. PNF will make airspeed call-outs and monitor engine performance.
   When engine fails, maintain runway centerline with rudder control only, minimizing deviation.
   Terminate maneuver after recovery from maximum centerline deviation has been accomplished.

- Procedure—Test Engineer / Pilot Not Flying (PNF):

  1. Confirm initial conditions.

  2. Make airspeed call-outs at 100 knots, VI, and Vr.

  3. Remove nose gear comering force at approximately 80 knots.

  4. AV Urneg, fail the outboard engine and call out "Engine 4 Failed."

  5. Note maximum centerline deviation.

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3-Dec-96 LJG

One Engine Out Takeoff

Fligh	it Phase	Σ L	MTE	Weather State	State	Failures
2A. Takeoff	ĮĮ	103. One engine out takeoff	gine out	1. Light Turb.		60. Single Engine Failure
Loading:	3. M13 - Max	Taxi Weight	ø fwd C.G., fu	ll aft fuselage fu	iel, partial w	nading;   3. M13 - Max Taxi Weight @ fwd C.G., full aft fuselage fuel, partial wing fuel, max payload
Head/X	Turb/	Approach	Celling/	Rwy		
Wind, kt	Gusts	Category	Visibility	Surface	ī	Initial Position
0 KV	Light/	0	Unlimited/	Dry,	End of 1	End of runway, on centerline.
0 Kt	None		Unlimited	grooved		

Abnormals/Exceptions:	None				
NORMAL	NORMAL	140	NO O	TO speed	Ref H Cyc 3
PSCAS	RSCAS	A/T	HUD	F/D	Config
170	186	200	202	215	181
ΙΛ	٧٢	Vlo		V2 + 10	
Field	0			DOWN	
ALT	KEAS/M	ĕ₩	0.0	GEAR	LEF/TEF

- Procedure–Evaluation Pilot (PF):

  1. Set brakes.

  2. Advance throttles to takcoff EPR.
  3. Release the pakes and aminain centerline during ground roll. PNF will make airspeed call-outs and monitor engine performance.

  4. At rotation speed (Vr), initiate rotation to follow rotation rate pitch guidance indicators. Utilize HUD guidance to preclude faul-strikes.

  5. At positive climb-rate, call "gear up". Follow velocity vector guidance symbol to intercept and maintain speed and extended runway centerline.

  5. Terminate the maneuver at 6.0 DME and in stable climb at V2+10.

- Procedure—Test Engineer / Pilot Not Flying (PNF):

  1. Confirm initial conditions.

  2. Make airspeed call-outs at 100 knots, VI, and Vr.

  3. Immediately after reaching VI, call "Engine # Failed, continue takeoff".

  4. Move gear handle to gear-up position when requested by PF.

  5. Terminate the maneuver at 6.0 DME and in stable climb at V2+10.

Date:	Pilot:		Runs:	
Evaluation Segment:	Evaluation Segment: Takcoff Roll, Rotation & Initial Climb Out - PLR	l Climb Out -	Long CHR	Long CHR Lat / Dir CHR
Start Evaluation: End Evaluation:	Stopped on Runway Just prior to second EPR cutback	ıck		
Evaluation Basis: The pilot is to evaluate the ea as the aircraft accelerates during the takeoff roll. T to track the pitch rate guidance indicators, and the PIO is allowed. No geometry strikes are allowed.	Evaluation Basis: The pilot is to evaluate the ease of tracking the runway centerline with rudder pedals alone as the aircraft accelerates during the takeoff roll. The pilot is to evaluate the control of the rotation and capability to track the pitch rate guidance indicators, and the ability to follow velocity-vector guidance once airborne. No PIO is allowed. No geometry strikes are allowed.	cking the runway or is to evaluate the coolons to follow velocity-v	centerline with rui ontrol of the rotati ector guidance or	dder pedals alone ion and capability ice airborne. No
Performa	Performance Standards	Target	Desired	Adequate
Runway Centerline Deviation, on ground (ft)	tion, on ground (ft)	0	₹10	±27
Rotation Pitch Rate Contol, on ground (deg)	il, on ground (deg)	generated	<±0.5 bracket	d±1 bracket 90%
		,	90% of time (±0.6 deg/s)	of time (±1.2 deg/s)
Longitudinal velocity vector control, airborne (de)	or control, airborne (de)	generated	✓ I V-vector	<±2 V-vector
		,	height 90% of	height 90% of
Lateral velocity vector control, airborne (deg)	hrol, airborne (deg)	generated	V-vector	<±2 V-vector
•	1	)	width 90% of	width 90% of
			time	dine.
Bank Angle Control, airborne (deg)	ome (deg)	0	£\$	∓10
Runway Heading Deviation, airborne (deg)	on, airborne (deg)	0	±2	±4

Long CHR Runs:

Pilot:

Date:

3-Dec-96 LJG

One Engine Out Takeoff in Crosswind

7036

Can's Call It at / Mil. Call	CHA LALY DIE CHA				rol of the rotation and capability	or guidance once airborne. No	
Evaluation Segment: Taleacff Doll Paration & Initial Olimb Oct.	PLR	Stopped on Runway	Just prior to second cars culoack	miles is to excellent and a second of a second of a second of a second of a second of a second of a second of a	as the aircraft accelerates during the takeoff roll. The pilot is to evaluate the control of the rotation and capability	No track the pitch rate guidance indicators, and the ability to follow velocity-vector guidance once airborne. No PIO is allowed. No segmetry strikes are allowed.	
Evaluation Segmen	i i	Start Evaluation: End Evaluation:		Ryshiption Basis: Th	as the aircraft accelerat	To track the pitch rate g	0
Failures	60. Single Engine Failure	al wing fuel, max payload		Initial Position	d of runway, on centerline.		/Exceptione:
Weather State	33. 35 Kt Crosswind	t fuselage fuel, partial v	Rwy	urface	Dry, End of		Ahnormak
MTE	100. Standard Acoustic 33. Takeoff	ing:   3. MI3 - Max Taxi Weight @ fwd C.G., full aft fuselage fuel, partit	Approach Ceiling/	Category Visibility 1	Unlimited 1		VI 1701 PSCAS NORMAI
Flight Phase	2A. Takeoff	Loading: 3. M13 - Max	Head/X Turb/	Wind, kt Gusts	0 KV Light 35 Kt None		ALT Field

Initial Position	End of runway, on center	Abnormals/Exceptions: None.	
Surface	Dry, grooved	1 1/1 5 5 5	22.7
Visibility	Unlimited/ Unlimited	170 PSCAS NORMAI 186 RSCAS NORMAI 200 A/T OFF 202 HUD TO Special P/D TO Special P	COMMENS 115/ 12
Category	0	H	1
Gusts	Light/ None	Field VI 0 Vr 549,914 VI 48.1 V2+10 Down V2+10	
Wind, kt	0 Kt/ 35 Kt	ALT Field KEAS/M 0 GW 649,914 C.G. 48.1 GEAF	

=±1/ <=1 bracket 90% of time (±1.2 deg/s) <=2 V-vector height 90% of

±10 <±0.5 bracket 90% of time (±0.6 deg/s) <±1 V-vector height 90% of

generated

ongitudinal velocity vector control, airborne (de)

Runway Centerline Deviation, on ground (ft) Rotation Pitch Rate Contol, on ground (deg)

Performance Standards

generated Target

Desired

	tor of wid	±5 ±10	±2 ±4									
	generated	0	0							-		
	Lateral velocity vector control, airborne (deg)	Bank Angle Control, airborne (deg)	Runway Heading Deviation, airbome (deg)				-					
Procedure-Evaluation Pilot (PF):	<ol> <li>Advance throttles to takeoff EPR.</li> <li>Release the brakes and maintain centerline during ground roll. PNF will make airspeed call-outs and</li> </ol>	monitor regard for initiate motiving to follow exercises the state of		<ol> <li>At positive climb-rate, call "gear up". Follow velocity vector guidance symbol to intercept and maintain speed and extended runway centerline.</li> <li>Terminate the maneuver at 6.0 DME and in stable climb at V2+10.</li> </ol>	Procedure-Test Engineer / Pilot Not Flying (PNF): 1. Confirm initial conditions.	1) 2. Transe improve the Transport of Novel 1, call "Engine # Failed, continue takeoff".  3. Immediately after reaching V1, call "Engine # Failed, continue takeoff".  4. Move gear handle to gear-up position when requested by PF.  5. Terminate the maneuver at 6.0 DME and in stable climb at V2+10.						

Runs:

Pilot:

### Minimum Control Airspeed - Air

7040

180	it Phase	Ξ	MTE	Weather State	State	Failures	
3A. Class	3A. Class B Airspace	604. Dynamic VMCA	ic VMCA	1. Light Turb.		60. Single Engine Failure	
Climb							
Loading:	oading: [7. MFC - Final Cruise condition	il Cruise condi	tion				
Head/X	Turb/	Approach	Ceiling/	Rwy			
Wind, kt	Gusts	Category	Visibility	Surface	I	Initial Position	
0 Kv	Light/	0	Unlimited/	Dry,	End of r	End of runway, on centerline.	
0 <b>K</b> t	None		Unlimited	grooved		•	

, d	Abnormals/Exceptions:	Outboard engine failure	_			
led grooved					OFF	٩Ē
Unlimited	PSCAS	RSCAS	Α⁄Τ	HUD	F/D	Config
	0	120	130	⋍		
_	RVC		<b>-</b>	Vmca		
None	Field	0	384,862	53.2	DOWN	Anto
0 Kt	ALT	<b>KEAS/M</b>	<b>≥</b>	C.G.	GEAR	LEF/TEF

Procedure-Evaluation Pilot (PF):

- Set brakes.
   Advance throttles to takeoff EPR.
   Advance throttles to takeoff EPR.
   Release brakes and perform normal takeoff maneuver.
   Call "Gear Up" at 50 ft altitude call.
   Fitch up to 30-35 degree pitch attitude at full throttle; allow airspeed to decay slowly to target Vmca.
   When engine fails, lower velocity vector to maintain Vmca and maintain runway heading with rudder control, minimizing heading deviation.
   Trim for zero sideslip angle using wing-low technique
   Terminate maneuver when steady-state conditions are achieved.

- Procedure—Test Engineer / Pilot Not Flying (PNF):
  1. Confirm initial conditions.
  2. Make airspeed call-outs at 100 knots, VI, and Vr.
  3. Raise gear at PF call.
  4. At Wrac, fail an outboard engine via fuel cutoff. Call out "Engine 4 Failed."
  5. Call out heading and airspeed values.

End Evaluation:		namic failure of	an outboard engin	re at low speed. ing 20 degrees o
Valuation Basis: Evalu Demonstrate ability to rec eading change during th	<b>Evaluation Basis:</b> Evaluate handling qualities during a dynamic failure of an outboard engine at low speed. Demonstrate ability to recover from engine failure and maintain Vmca airspeed without exceeding 20 degrees of heading change during the maneuvernor more than 5 degrees of bank angle at steady-state trim.	tain Vmca airspe	ed without exceed It steady-state trim	_
Performs	Performance Standards	Target	Desired	Adequate
Maximum heading deviation (deg)	ion (deg)	0	∓10	±20
Maximum bank angle deviation (deg)	viation (deg)	0	Ş	0I>
Acres A managed		_	ř	VI+

		7040
		•
		7040

11-Dec-96 DLR

Plot:

Date:

Lat / Dir CHR

Long CHR Runs:

Landing Approach Stabilized on Constant Heading

engines out

**Dynamic VMCL-2** 

7050

Evaluation Basis: Evaluate handling qualities during a dynamic failure of two engines on the same wing with full asymmetric thrust. Demonstrate ability to recover from second engine failure at approach speeds as slow as 140 knots. Evaluation Segment: Minimum Control Speed - Landing Config. Two Start Evaluation: End Evaluation: Failures ond Engine Failur fer OM 16A. Final Approach Loadine: 7. MFC - Fina

	Initial Positi	On G/S and LOC, aft	Abnormals/Exceptions: One inboard engine inop
	Rwy Surface	Dry, grooved	l ,
non	Ceiling/ Visibility	Unlimited/ Unlimited	TBD
Locuing. 1. MIC Fills Cruise condition	Approach Category	0	Vapp TBD Vef 154 Vg/a TBD Vmin 125
"IMILY - LI	Turb/ Gusts	Light/ None	1,500 TBD 384,862 53.2 DOWN
Locality	Head/X Wind, kt	0 KV 0 Kt	KEAS/M GW 3 C.G. GEAR LEF/TEF

- Procedure-Evaluation Pilot (PF):

  1. Maintain a 3 degree glideslope at Vapp
  2. When the outboard engine fails, advan
  3. Maintain airspeed, minimize course de4. Recover to nominal course and speed.
- Maintain a 3 degree glideslope at Vapp with zero bank angle and one inboard engine inop.

  When the outboard engine fails, advance two remaining engines as required to maintain approach speed.

  Maintain airspeed, minimize course deviation.

  Recover to nominal course and speed. Maintain airspeed. Restrict new trim bank angle to no greater than 5 degrees.

- Procedure—Test Engineer / Pilot Not Flying (PNF):

  1. Confirm initial conditions.

  2. When stabilized on 3 degree glideslope, fail the outboard engine on the same wing as the inop inboard engine via fuel shutoff. Call out "Engine X Failed."

  3. Call out airspeed deviations.

heading deviation (deg)	0	0[∓	±20
bank angle deviation (deg)	0	Ø	elv V
in Airspeed	0	ţ	===
			212
	heading deviation (deg) bank angle deviation (deg) in Airspeed	heading deviation (deg) 0 bank angle deviation (deg) 0 in Airspeed 0	heading deviation (deg) 0 ±10  bank angle deviation (deg) 0 <5 in Airspeed 0 ±5

10-Jan-97 EBJ

Date:

Long CHR Lat / Dir CHR

Runs:

Pilot:

Evaluation Basis: Evaluate handling qualities during recovery from an upset induced by one or more inlet unstarts coupled with an engine failure. Perform maneuver quickly and smoothly, with no tendency to oscillate or hunt for bank angle and pitch attitude throughout the maneuver.

Straight and Level Flight Straight Flight (Descent)

Start Evaluation: End Evaluation:

Evaluation Segment: Inlet Unstart

Adequate ±0.3 ±20 ±10

Desired ±0.1 ±10 ±5

Target

Performance Standards
Max, Load Factor Deviation in Recovery (g)
Maximum Bank Angle (deg)
Deviation from Initial Heading (deg)

Ripple Unstart

Jella.	oppose	-	T T T T T T T T T T T T T T T T T T T		24.24	
F.11.K	IL FIRSC	I.V.	77	Weather State	State	FRIUTES
7C. Supers	onic Cruise	610. Ripple (	Unstart	I. Light Turb.		63. Ripple Unstart
Loading:	7. MFC - Fins	MFC - Final Cruise condition	tion			
Head/X	Turb/	Approach	Ceiling/	Rwy		
Wind, kt	Gusts	Category	Visibility	Surface	_	Initial Position
0 KV	Light/	0	Unlimited/	Dry,		N/A
0 Kt	None		Unlimited	prooved		

Initial Position	Y/N	Abnormals/Exceptions: One inboard engine inop	
. e	g.	<b>4</b> 8	
Surface	Dry, grooved	NORMAL NORMAL OFF ON OFF	,
lity	ted/ ited		•
Visibility	Unlimited/ Unlimited	EPR Trim PSCAS NORMAL R/C 0 RSCAS NORMAL A/T OFF HUD ONF FID ONF	)
Category		Trim 0	
Cate	٥	PR VC	
Gusts	Light/ None	I 64,000 E M M 2.4 R V 384,862 5. 53.2 6. 0P	
Wind, kt	0 Kv 0 Kt	ALT 64,000 KEAS/M M.24 GW 384,862 C.G. 53.2 GEGR UP	

COULTE AUTOCO	Procedure-Evaluation Pilot (PF):  1. Establish straight and level flight at stated conditions on a cardinal heading.  2. Upon hearing "Recover," recover to straight and level flight and maintain assigned altitude. Use rudder to correct for yaw deviations. A small steady-state bank angle is acceptable.  3. Upon hearing "Engine X Failed," retard the appropriate throult to idle.  4. Terminate when in steady level decelerating flight with little or no sideslip.	Procedure—Test Engineer / Pilot Not Flying (PNF):  1. Confirm initial conditions. 2. At an appropriate time, command an inboard engine inlet unstart, coupled with an engine failure. Immediately following unstart theoutboard inlet on the same side. 3. Immediately acl out "Excover." 4. As soon as cockpit indications detect symptoms of the engine failure, call out "Engine X Failed." 5. Verify, if possible, that both inlets automatically restart within one seconds. 5. Verify that the PDF has retarded the throttle on the failed engine and that the engine remains windmilling.	

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	ŀ
	7060
	70

Engine-out Stall

Lone CHR It at / Dir CH					ath or skill No control section	igul of skill, Ivo Colludi ievelsals of
ent: Stalt	Standar Sinks minner land	Steady Ingui, Wings level Wines level at menument angle of attach	condition		Manuever mostible without exceptional piloting street	PIO. Recovery never in question.
Evaluation Segment: Staff	Start Evaluation:	End Evaluation:	•		Evaluation Basis:	PIO. Recovery neve
Failures	60. Single Engine Failure			Initial Position	NA	
Weather State	1. Light Turb.		Rwy	Surface	Dry,	grooved
MTE	07. Engine-out Stall	ruise condition	pproach Celling/	ategory   Visibility	0 Unlimited	Unlimited
Н	۴	inal C	Ľ	7		4

Long CHR Lat / Dir CHR

Runs:

Pilot:

Date:

3-Dec-96 EBJ

Abnormals/Exceptions: One outboard engine inop	
NORMAL ON OFF ON OFF OFF OFF	
PSCAS RSCAS A/T HUD F/D	
Trim 75%	
R/C Thrust	
10,000 155 384,862 53.2 UP Auto	
KEASM CW 3 C.G. GEAR LEF/TEF	

					7070
Procedure—Evaluation Pilot (PF):  1. Establish straight climbing flight at the indicated conditions on a cardinal heading with zero sideslip.  2. Using pitch inputs to control flight path angle, establish and maintain a smooth deceleration of I knot per second.  3. Decelerate to an airspeed which produces approximately 21 degrees angle-of-attack before initiating recovery, lower the nose and maintain wings-level.  4. At recovery, lower the nose and maintain wings-level.  5. Terminate the maneuver when recovery is assured (i.e. wings level with AOA less than 13 degrees and steady). No throttle adjustments are allowed.	Procedure—Test Engineer / Pilot Not Flying (PNF): 1. Confirm initial conditions. 2. Monitor deceleration and call out deviations from the target rate. Verify flaps are automatically extending on schedule. 3. Call out "recover" when angle-of-attack reaches 21 degrees. 4. Verify flaps retract during recovery. 5. Terminate maneuver when recovery is assured (i.e. wings level with AOA less than 13 degrees and steady).				7070

Long CHR | Lat / Dir CHR

30 degree banked turn Wings level at recovered angle of attack condition

Runs:

Pilot:

Evaluation Segment: Turning Stall

Start Evaluation: End Evaluation:

**Engine-out Turning Stall** 

Fligh	it Phase	Σ	MTE	Weather State	State	Failures
4B. Subsonic	ic Climb	608. Engine Stall	608. Engine-out Turning 1.	1. Light Turb.		60. Single Engine Failure
Loading:	7. MFC - Fine	7. MFC - Final Cruise condition	tion			
Head/X	Turb/	Approach	Ceiling/	Rwy		
Wind, kt		Category	Visibility	Surface	H	Initial Position
0 KJ	Light	0	Unlimited/	Dry.		WA
o Kt	None		Unlimited	grooved		

Initial Positi	N/A		Abnormals/Exceptions:	One outboard engine inon	Jan. 1			
Rwy Surface	Dry, grooved	١ '	NORMAL A			NO O	OFF	Cvc 3
Celling/ Visibility	Unlimited/ Unlimited				A/T	HUD	F/D	Config Ref H Cvc 3
Approach Category	0		R/C Trim PSCAS	Thrust 75%				
	Light/ None		10,000	155	84,862	53.2	J.	Auto
Head/X Wind, kt	0 KV 0 Kt		ALT	KEAS/M	ĕS	C.G.	GEAR	LEF/TEF

Adequate ±10 Not Divergent **Evaluation Basis:** Manuever possible without exceptional piloting strength or skill. No control reversals or PIO. Recovery never in question. Desired 0 No PIO Target Performance Standards Wings level bank angle (deg) Pilot Induced Oscillations (PIO)

					7080
CEAR   UP   FID OFF	Procedure—Test Engineer / Pilot Not Flying (PNF):  1. Confirm initial conditions. 2. Monitor deceleration and call out deviations from the target rate. Verify flaps are automatically extending on schedule. 3. Call out "recover" when angle-of-attack reaches 21 degrees. 4. Verify flaps retract during recovery. 5. Terminate maneuver when recovery is assured (i.e. wings level with AOA less than 13 degrees and steady).				7080

27-May-97 DLR

Date:

Long CHR Lat / Dir CHR

1,500 ft, Final Approach Speed, Level 200 ft AGL, Landing Speed, Descending

Runs:

Pilot:

Manual Thrust Landing

7095

Evaluation Segment: Glideslone Intercent		Caro Evatuation: 200 ft AGL, Landing	Evaluation Basis: Evaluate the ability to rapid	Derformense Stondense
State Fallures			Initial Position	3 nm from threshold, on LOC.
Weather State	15A. Initial Approach Fix   313. Complete Approach   1. Light Turb.		Rwy v Surface	Dry, grooved
LITE	ete Approach	ition	Head/X Turb/ Approach Ceiling/ Wind, kt Gusts Category Visibility	Unlimited Unlimited
¥  -	c 313. Compland Landing	al Cruise cond	Approach Category	٥
it Phase	l Approach Fir	Loading: 7. MFC - Final Cruise condition	Turb/ Gusts	Light/ None
FILE	15A. Initia	Loading:	Head/X Wind, kt	0 KV 0 Kt

	Abnormals/Exceptions:	None					
	39 PSCAS NORMAL		NORMAL	OFF	NO O	OFF	Config Ref H Cyc 3
	PSCAS		RSCAS	A/T	125 HUD	F/D	Config
	651		<u>₹</u>	159	125		
	Vapp				Vmin		
	1,500		8	384,862	53.2	J.	Auto
	ALT		KEAS/M	<b>₹</b>	<u>ن</u> ن	GEAR	LEF/TEF

- Procedure–Evaluation Pilot (PF):

  1. Establish aircraft in steady level flight at the noted conditions, tracking LOC.

  2. Slow to Vapp when instructed by PNF.

  3. Capture G/S. Track LOC and G/S using HUD or PFD.

  4. Manually retard throttles and execute a flare to touchdown at the target point on the runway.

  5. After touchdown, retard throttles to idle and lower the nosewheel to the runway.

78

Procedure—Test Engineer / Pilot Not Flying (PNF):

1. Confirm initial conditions.

2. When DME reads 7.0, instruct PF to decelerate to Vapp.

3. 1/2 dot before G/S capture, call out "Gear Down" and move gear handle to down position.

A STATE OF THE COLOR OF THE TRANSPORT OF THE STATE OF THE	JAHIHARCIY O.D IIIII IIC		•
Performance Standards	Target	Desired	Adequate
Dev. from Final Appr. Airspeed (KEAS)	Vapp	£\$	110
Deviation from Glideslope (dots)	0	∓0.5	₹1.0
Deviation from Localizer (dots)	0	±0.5	0.1±

Evaluation Segment: Precision Landing	Precision Landing	Long CHR	Long CHR Lat / Dir CHR
Start Evaluation: End Evaluation:	200 ft AGL, Landing Speed, Descending Nosewheel touchdown		
Evaluation Basis: Evalus tendency to PIO or bobble touchdown.There should b	Evaluation Basis: Evaluate handling qualities in landing. For desired performance, there should be no tendency to PIO or bobble in pitch or roll. There should also be no tendency to float or bounce after couchdown. There should be no geometry strikes on touchdown.	ormance, there sh to float or bounce	ould be no after

_				
	Performance Standards	Target	Desired	Adequate
	Deviation from Approach Airspeed at 50 ft (kt)	0	<b>\$</b> ∓	91∓
	Deviation from Runway Heading at touchdown (deg)	0	£3	9∓
	Longitudinal distance from threshold at touchdown (ft)	1250	1000-1500	750-2250
	Lateral offset from runway centerline at touchdown (ft)	0	0IŦ	±27
	hdowr	Ī∨	\$4	15
	Maximum Bank Angle below 50 ft AGL (deg)	0	#3	<b>L</b> Ŧ
	Pilot Induced Oscillations (PIO)	No PIO	No PIO	Not Divergent
	Geometry Strikes (tail, engine nacelle, wing tip)	No Strikes	No Strikes	No Strikes

Unaugmented Landing

Filg	nt Phase	М	TE	Weather State	State	Failures	
ISA. Initia	Initial Approach Fix 313. Complete Approach	313. Comple	te Approach	1. Light Turb.		80. Direct Electrical Link	
		and Landing	;	1		reversion	
Loading: 7.	7. MFC - Fins	7. MFC - Final Cruise condition	tion				
Hcad/X	Turb/	Approach	Ceiling/	Rwy			
Wind, kt	Gusts	Category	Visibility	Surface	-	Initial Position	
0 KV	Light	0	Unlimited	Dry,	3 nm outs	nm outside OM, 4,500 ft right of	
0 Kt	None		Unlimited	grooved	runway (	unway centerline, on 30 degree	
					-	Intercent course	

Abnormals/	All Controls N				
DET		Ī	NO	Ī	Ref H Cyc 3
PSCAS	RSCAS				Config
125	159	154	159	125	
Vman			Vg/a		
1,500	<u> </u>	384,862	53.2	UP	Auto
ALT	KEAS/M	ĕ	C.G.	GEAR	LEF/TEF

/Exceptions: Manual.

- Procedure-Evaluation Pilot (PF):

  1. Establish aircraft in steady level flight at the noted conditions, tracking LOC.

  2. Slow to Vapp when instructed by PNF.

  3. Capture G/S. Track LOC and G/S using HUD.

  4. Disconnect autothrottles at 50 ft Act and a the standard throttles and a crecute a flare to touchdown at the target point on the runway.

  5. Manually retard throttles and accuse and lower the nosewheel to the runway.

- Procedure—Test Engineer / Pilot Not Flying (PNF):

  1. Confirm initial conditions.

  2. When DME reads 7.0, instruct PF to decelerate to Vapp.

  3. 1/2 dot before G/S capture, call out "Gear Down" and move gear handle to down position.

Not Divergent No Strikes

54 £5 No PIO No Strikes

0 No PIO No Strikes

Deviation from Approach Airspeed at 30 ft (kt)
Deviation from Runway Heading at touchdown (deg)
Longitudinal distance from threshold at touchdown (ft)
Lateral offset from runway centerline at touchdown (ft)
Sink Rate at touchdown (ft/sec)
Maximum Bank Angle below 50 ft AGL (deg)
Filot Induced Oscillations (PIO)
Geometry Strikes (tail, engine nacelle, wing tip)

±6 750-2250

±3 1000-1500

Date:		Pilot:		Runs:	
Evalus Start Ev End Ev	Evaluation Segment: Start Evaluation: End Evaluation:	Evaluation Segment: Glideslope and Localizer Intercept Start Evaluation: 1,500 ft, Final Approach Speed, Level End Evaluation: 200 ft AGL, Landing Speed, Descending	cept d, Level escending	Long CHR	Lat / Dir CHR
Evalua nomina (approx	rtion Basis: Evalu il approach profile cimately 0.5 nm fr	Evaluation Basis: Evaluate the ability to accurately maneuver onto the final approach path and maintain nominal approach profile and speed at low altitudes. Attained trimmed flight before the middle marker (approximately 0.5 nm from the end of the runway).	euver onto the fin ned trimmed fligh	al approach path a t before the middle	nd maintain : marker
	Perform	Performance Standards	Target	Desired	Adequate
Deviati	on from Final Ap	Deviation from Final Approach Airspeed (kt)	0	#\$	ΩIŦ
Deviati	Deviation from Glideslope (dots)	e (dots)	0	±0.5	₹1.0
Deviati	Deviation from Localizer (dots)	(dots)	0	±0.5	∓1.0
Evalua	Evaluation Segment:	Precision Landing		Long CHR	Lat / Dir CHR
Start Ev End Ev	Start Evaluation: End Evaluation:	200 ft AGL, Landing Speed, Descending Nosewheel touchdown	escending		
Evalua tendenc	rtion Basis: Evaluty to PiO or bobbl	Evaluation Basis: Evaluate handling qualities in landing. For desired performance, there should be no tendency to PIO or bobble in pitch or roll. There should also be no tendency to float or bounce after fourthdown. There should be no competity enrices on touchdown.	g. For desired per Iso be no tendency	formance, there sh	iould be no
	Performs	Performance Standards	Target	Desired	Adequate

7100

27-May-97 DEH

Date:

Runs:

Pilot:

Standard Acoustic Takeoff/Flaperon Hardover

7211

Fligi	nt Phase	M	TE	Weather State	State Fallures	
2A. Takeoff	<u></u>	100. Standar Takeoff	00. Standard Acoustic akeoff	1. Light Turb.	112. Two aileron Panels (Asymmetric)	anels
Loading:	3. MI3 - Max	Taxi Weight (	@fwdC.G., fu	ll aft fusclage fo	.oading:   3. M13 - Max Taxi Weight @ fwd C.G., full aft fuselage fuel, partial wing fuel, max payload	L
Head/X	Turb/	Approach	Celling/	Rwy		
Wind, kt	٦	Category	Visibility	Surface	Initial Position	
0 KV	/ygir]	0	Unlimited/	Dry,	End of Runway on Centerline	١
0 Kt	None		Unlimited	grooved	•	

Abnormals/Exception Flaperon Hardover after	<u> </u>	166 PSCAS NORMAL 200 AJT ON 202 HUD ON 212 BACH COPE	202 202 212	VI VI V2 V2+10	ALT Field S/M 0 GW 649,914 C.G. 48.1 EAR DOWN	ALT KEAS/M GW C.G. GEAR LEF/TEF
End of Runway	Dry, grooved	Unlimited/ Unlimited	0		Light None	0 Kr 0 Kr
Initial I	Rwy Surface	Celling/ Visibility	Approach Category			Head/X Wind, kt

r rotation.

Note: This maneuver is to be performed with the leading- and trailing-edge flaps fixed to 30/10 degrees.

- Procedure–Evaluation Pilot (PF):

  1. Set brakes.
  2. Advance throttles to takeoff EPR.
  3. Release the brakes and maintain centerline during ground roll. PNF will make airspeed call-outs and monitor engine performance.
  4. At rotation speed (Vr), initiate rotation to follow rotation rate pitch guidance indicators. Utilize HUD guidance to preclude tail-strikes.
  5. At positive climb-rate, call "gear up". Follow velocity vector guidance symbol to intercept and maintain speed and extended runway centerline.
  6. When established at V2+10, PNF takes control of the throttles.
  7. Maintain target climb airspeed and runway heading throughout cutback maneuver.
  8. Terminate maneuver at 8.0 DME to record data for acoustic calculations.
- ... 80

- Procedure—Test Engineer / Pilot Not Flying (PNF):

  1. Confirm initial conditions.

  2. Make airapeed call-outs at 100 knots, V1, and Vr.

  3. Call out "flaperon hardover".

  4. Move gear handle to gear-up position, when requested by PF.

  5. Monitor gear retraction and automatic device retraction.

  6. Make altitude call-outs at 500 and 600 feet A 7100 feet, call "cutback" and manually retard throttles to cutback EPR (50%) over an approximately 7 second interval.

  7. Maintain cutback condition until 8.0 DME for acoustic calculations.

Evaluation Segment:	Evaluation Segment: Rotation & Initial Climb Out		Long CHR	Long CHR   Lat / Dir CHR
Start Evaluation: End Evaluation:	Vr Just prior to EPR cutback			
Evaluation Basis: The pilot is capture the target climb speed.	Evaluation Basis: The pilot is to evaluate the ability to rotate promptly (without tail strike), liftoff, and capture the target climb speed.	otate promptly (w	ithout tail strike),	liftoff, and
Performs	Performance Standards	Target	Desired	Adequate
Rotation pitch attitude (deg)	(8	2	10±0.5	ē
Deviation from climb speed (kt)	ed (kt)	0	#5	₹10
Overshoot of max allowable pitch attitude (deg)	ole pitch attitude (deg)	0	V	42
Bank Angle Control (deg)		0	±5	01 <del>T</del>
Runway Heading Deviation (deg)	on (deg)	0	±2	±4
Pilot Induced Oscillations (PIO)	(PIO)	No PIO	No PIO	Not Divergent
Geometry Strikes (tail, engine nacelle, wing tip)	gine nacelle, wing tip)	No Strikes	No Strikes	No Strikes

27-May-97 DEH

Date:

Long CHR | Lat / Dir CHR

Evaluation Segment: Rotation & Initial Climb Out

Pilot:

Just prior to EPR cutback

Start Evaluation: End Evaluation:

Runs:

### Standard Acoustic Takeoff/Elevator Hardover (TE Down) 7212

Failures	
Weather State   F	b. 111. Both elevator panels
Weather	1. Light Turb
MTE	00. Standard Acoustic 1. Light Turb. Takeoff
Phase	100. Sta Takeoff
Flight Phase	2A. Takeoff

eptions:	er (TE Down)				
Abnormals/Exc	Elevator Hardover	٠.	tancoli.		
NORMAL	NORMAL	NO O	NO O	OFF	Ref H Cyc 3
PSCAS	RSCAS	A/T	HUD	F/D	Config
199	186	200	202	212	
5	<u>,</u>	VLO		-	
Field	0				30/10
ALT	KEAS/M	ĕ	၁.၁	GEAR	LEF/TEF

after

Note: This maneuver is to be performed with the leading- and trailing-edge flaps fixed to 30/10 degrees.

### Procedure-Evaluation Pilot (PF):

- Set brakes.

  Advance throttles to takeoff EPR.

  Release the brakes and maintain centerline during ground roll. PNF will make airspeed call-outs and monitor engine performance.
  - At rotation speed (Vr), initiate rotation to follow rotation rate pitch guidance indicators. Utilize HUD guidance to preclude tail-strikes.
- S. At positive climb-rate, call "gear up". Follow velocity vector guidance symbol to intercept and maintain speed and extended runway centerline.

  6. PF calls "Taps up" after failure

  7. When established at V2+10, PNF takes control of the throttles.

  9. Maintain target climb atrapeed and runway heading throughtout cutback maneuver.

  9. Terminate maneuver at 8.0 DME to record data for acoustic calculations.

## Procedure-Test Engineer / Pilot Not Flying (PNF):

- Confirm initial conditions.

  Make airspeed call-outs at 100 knots, V1, and Vr.

  Move gear handle to gear-up position, when requested by PF.

  Monitor gear retraction and automatic device retraction.

  Call out "elevator hardover".

  Retract flaps when requested by PF.

  Make altitude call-outs at 500 and 600 feet. At 700 feet, call "cutback" and manually retard throttles to cutback EPR (56%) over an approximately 7 second interval.

  Maintain cutback condition until 8.0 DME for acoustic calculations.

Evaluation Basis: The pilot is to evaluate the ability to rotate promptly (without tail strike), liftoff, and capture the target climb speed.	rotate promptly (w	ithout tail strike),	liftoff, and
Performance Standards	Target	Desired	Adequate
Rotation pitch attitude (deg)	10	\$.0±01	1701
Deviation from climb speed (kt)	0	£	₹10
Overshoot of max allowable pitch attitude (deg)	0	l>	<b>4</b> 7
Bank Angle Control (deg)	0	£	01∓
Runway Heading Deviation (deg)	0	₹5	¥4
Pilot Induced Oscillations (PIO)	Old oN	No PIO	Not Divergent
Geometry Strikes (tail, engine nacelle, wing tip)	No Strikes	No Strikes	No Strikes

20-Nov-96 DEH

Date:

Long CHR Lat / Dir CHR

Runs:

Evaluation Basis: Evaluate handling qualities in landing. For desired performance, there should be no tendency to PIO or bobble in pitch or roll. There should also be no tendency to float or bounce after touchdown. There should be no geometry strikes on touchdown.

200 ft AGL, Landing Speed, Descending Nosewheel touchdown

Precision Landing

Evaluation Segment:

Start Evaluation: End Evaluation:

Pilot:

Precision Landing/Elevator Hardover (TE Down)

7252

Fligh	nt Phase	M	TE	Weather State	State	Failures
17A. Land	ing	303. Precision L	on Landing	1. Light Turb.	111.8	oth elevator panels
Loading:	7. MFC - Fini	7. MFC - Final Cruise condition	tion			
Head/X	Turb/	Approach	Celling/	RWV		
Wind, kt	Gusts	Category	Visibility	Surface	Initial Position	Position
0 KV	Light	0	Unlimited/	Dry,	400 ft AGL; On LOC & G/S	n LOC & G/S
0 Kı	None		Unlimited	grooved		

	400 f	Abnormals/Exceptions: Elevator Hardover (TE Down approach.	
Rwy Surface	Dry, grooved		چ د
Ceiling/ Visibility	Unlimited/ Unlimited	159 PSCAS NORMAL 154 RSCAS NORMAL 159 A/T ON 125 HUD ON	œ
Approach Category	0	Vapp 159 Vref 154 Vg/a 159 Vmin 125	
	Light/ None	400 AGL 157 157 53.2 9WN	Auto
Head/X Wind, kt	0 KV 0 Kı	ALT KEAS/M GW 384 C.G.	LEF/TEF

Procedu 1. PF cs 2. PF tr 3. PF cs 4. At ap landiii 5. After 6. After

Procedu 1. Confi 2. Call c 3. Reset

Target Desired Adequate	S# 0	0 ±3	1) 1250 1000-1500 75	0 1	 	No PIO No PIO Not I	No Strikes No Strikes					
CAS NORMAL Abnormals/Exceptions:	Elevator Hardover (TE Down) during	NORMAL annuach		OFF OFF	Ref H C		Festablishes aircraft in steady descending flight at the noted conditions. F establishes aircraft in steady descending flight at the noted conditions. F tracks GIS and LOC using HUD. F track					
ALT 400 Vapp 159 PSCAS	AGL :	Vref 154	384,862 Vg/a 159	NMOO			Festablishes aircraft in steady descending flight at the noted conditions. F reals "reset GIS and LOC using HUD.  F calls "reset flaps" after failure.  I appropriate altitude, PF maneuvers to touchdown on the aim point on rading.  Iter touchdown, lower the nosewheel to the runway while retarding thruffer nosewheel touchdown, apply normal braking until below 80 knots, edure—Test Engineer / Pilot Not Flying (PNF):  all out elevator hardover.  all out elevator hardover.					

Long CHR Lat / Dir CHR

Runs:

Evaluation Basis: Evaluate handling qualities in landing. For desired performance, there should be no tendency to PIO or bobble in pitch or roll. There should also be no tendency to float or bounce after touchdown. There should be no geometry strikes on touchdown.

200 ft AGL, Landing Speed, Descending Nosewheel touchdown

Evaluation Segment: Precision Landing

Start Evaluation: End Evaluation:

Pilot:

Desired

Target

Performance Standards

Precision Landing/Rudder Hardover

Flight	Phase	M	MTE	Weather State	State	Failures	
17A. Landing		303. Precisio	303. Precision Landing	1. Light Turb.		42. One Rudder Panel Hardover	
Loading:	7. MFC - Finz	oading: 7. MFC - Final Cruise condition	tion				
Head/X	Turb/	Approach		Rwy			
Wind, kt	Gusts	Category	Visibility	Surface	=	Initial Position	
0 KV	Light/	0	Unlimited	Dry,	400 ft /	00 ft AGL; On LOC & G/S	
0 K.	None		Unlimited	grooved			

Abnormals/Exceptions:	Rudder Hardover during annroach					
159 PSCAS NORMAL		NORMAL	NO	NO	OFF	Config Ref H Cyc 3
PSCAS		RSCAS	A/T	125 HUD	F/D	Config
159		154	159	125		
 Vapp		Vref	Vg/a	Vmin		
400	AGL	157	384,862	53.2	DOWN	Auto
ALT		KEAS/M	80		GEAR	LEF/TEF

<b>-</b> ,	-1	7	7	7	1	<del>]  </del>	7	I	1	1	1		1	
Adequate	01#	οŢ	750-2250	177	<u>i</u>	Not Divergent	No Sinkes							
Desired	£‡	£‡	1000-1500	710	\$ <del>\$</del>	No PIO	NO SITIKES			The state of the s				
Target	0	0	0671	,	, 0	No PIO	No Strikes							
Feriormance Standards	Deviation from Duming Hading at 500 ft (kt)	Deviation from Kultway freating at touchdown (deg)	Longitudinal distance from direspoid at (ouchdown (ft)	Sink Rate at touchdown (filesc)	Maximum Bank Angle below 50 ft AGL (deg)	Pilot Induced Oscillations (PIO)	Ocomety's strikes (tan, engine nacene, wing up)							
	Abnormals/Exceptions:	Kudder Hardover during approach.					Prestablishes aircraft in steady descending flight at the noted conditions. PF establishes aircraft in steady descending flight at the noted conditions. PF tracks G/S and LOC using HUD.  At appropriate altitude, PF maneuvers to touchdown on the aim point on runway with a normal flare and landing.  After touchdown, lower the nosewheel to the runway while retarding thrust to idle.  After nosewheel touchdown, apply normal braking until below 80 knots, maintaining runway centerline.  Confirm initial conditions.							
	159 PSCAS NORMAL		159 A/T	125 HUD	F/D OFF	Config Ref H Cyc 3	Procedure–Evaluation Pilot (PF):  2. PF establishes aircraft in steady descending flight at the noted conditions.  2. PF tracks G/S and LOC using HUD.  3. At appropriate altitude, PF maneuvers to touchdown on the aim point on runway will anding.  4. After touchdown, lower the nosewheel to the runway while retarding thrust to idle.  5. After nosewheel touchdown, apply normal braking until below 80 knots, maintaining Procedure—Test Engineer / Pilot Not Flying (PNF):  7. Confirm initial conditions.							
	ALT 400 Vapp	TOWN TOTAL	384.862	C.G. 53.2 Vmin	GEAR DOWN	LEF/TEF Auto	Procedure-Evaluation Pilot (PF):  1. PF establishes aircraft in steady descending flight at the not.  2. PF tracks G/S and LOC using HUD.  3. At appropriate altitude, PF maneuvers to touchdown on the landing.  4. After touchdown, lower the nosewheel to the runway while for nosewheel touchdown, apply normal braking until be Procedure—Test Engineer / Pilot Not Flying (PNF):  1. Confirm initial conditions.  2. Call our incides haddown.							

27-Мау-97 DEH

Date:

Long CHR | Lat / Dir CHR

Runs:

Pilot:

S7 ±7 Not Divergent No Strikes

0 No PIO No Strikes

Deviation from Aproach Airspeed at 50 ft (kt)
Deviation from Runway Heading at touchdown (dg)
Longitudinal distance from threshold at touchdown (ft)
Lateral offset from runway centerline at touchdown (ft)
Mir Rate at touchdown (ff/sec)
Maximum Bank Angle below 50 ft AGL (deg)
Filor Induced Oscillations (PIO)
Geometry Strikes (tail, engine nacelle, wing tip)

±6 750-2250 ±27

1000-1500 11000-1500

Desired

Target

Performance Standards

Precision Landing/Rudder Hardover during Rollout

7254

Tome CHB II at / Bir. C	LOUIS CAIN LAIL! DIE C.				Normance, unere should be no IV to float or bounce after	
Evaluation Segment: Precision Landing	Start Fvaluation: 200 & 201 12 22 2	End Evaluation: November 1 to the Landing Speed, Descending	•	Evaluation Racie: Evaluate handling qualities in landing Ext. denimal and	tendency to PIO or bobble in pitch or roll. There should also be no tendency to float or hounce after	touchdown. There should be no geometry strikes on touchdown.
Fallures	113. All Rudder panels			Initial Position	400 ft AGL; On LOC & G/S	
Weather State	1. Light Turb.		Rwy	Surface	Dry, 400	grooved
MTE	cision Landing	ndition	h Ceilling/	y Visibility	Unlimited	Onlimited
١	303. Pre	Final Cruise co	b/ Approa	ts Categoi	0 /	
Flight Phas	17A. Landing	Loading: 7. MFC	Head/X Tur	Wind, kt Gus	0 KV Light	ONI NON

				Picorial Brown		
	Vapp		159 PSCAS NORMAL	NORMAL	Abnormals/Exceptions:	
32F	Vref	2	RSCAS	IAMGON	Rudder Hardover after	main gear
	Ve/8	159	159 A/T	N	touchdown.	
-	nin'	125	HUD	Ö		
フ			F/D	OFF		
•			Config A	Config Ref H Cyc 3		

conditions.	hardover.
onfirm initial	all out rudder
 	ري ت

Procedure—Evaluation Pilot (PF):  1. PF establishes aircraft in steady descending flight at the noted conditions.  2. PF tracks G/S and LOC using HUD.  3. At appropriate altitude, PF maneuvers to touchdown on the aim point on runway with a normal flare and landing.  4. After touchdown, lower the nosewheel to the runway while retarding thrust to idle.  5. After nosewheel touchdown, apply normal braking until below 80 knots, maintaining runway centerline.  Procedure—Test Engineer / Pilot Not Flying (PNF):  1. Confirm initial conditions.  2. Call out rudder hardover.	Geometry Strikes (tail, engine nacelle, wing tip)	No Strikes	No Strikes	No Srrikes	
84	·				
			-		
T JUL					

Long CHR | Lat / Dir CHR

Straight and Level Flight (Cruise) Straight Flight

Start Evaluation: End Evaluation:

Runs:

Pilot:

Evaluation Segment: 2-axis Upset

## 2-Axis Upset/Elevator Hardover (TE Up)

Fligi	nt Phase	M	MTE	Weather State	State	Failures
7C. Supers	upersonic Cruise	505. Simulated 2-Axis	ted 2-Axis	1. Light Turb.		111. Both elevator panels
•		Gust Upset, High Speed	High Speed			
Loading:	oading: [7. MFC - Final Cruise condition	d Cruise condi	tion			
Head/X	Turb/	Approach	Celling/	Rwy		
Wind, kt	Gusts	Category	Visibility	Surface	Ī	Initial Position
0 Kv	Light	0	Unlimited	Dry,		N/A
0 Kt	None		Unlimited	grooved		

- Procedure–Evaluation Pilot (PF):

  1. Establish straight and level flight at M 2.4.

  2. Reduce throttle to 50% and pull up gently to decelerate to M 2.3.

  3. Establish a flight path angle of 6 degrees below the horizon, then roll to a bank angle of 15 degrees.

  4. Maintain this attitude for 3 seconds.

  5. Roll wings level.

  6. Execute a 1.5 g pull-up to recover to level flight. Advance throttles to full to begin acceleration.

  7. Terminate the maneuver after all transients have quiesed.

- Procedure—Test Engineer / Pilot Not Flying (PNF):
  1. Confirm initial conditions.
  2. Count off 3 seconds after reaching M 2.4 and call out "Recover."
  3. Trigger elevator hardover.
  4. Call out elevator hardover.
  5. Monitor load factor during recovery and provide feedback to PF if necessary to ensure a smooth 1.5 g recovery.

tion		Evaluation Basis: Maneuver is possible without exceptional piloting strength or skill and without exceeding Md.	oting strengt	h or skill and wi	thout exceeding
	_	Performance Standards Tar	[arget	Desired	Adequate
		Maximum Bank Angle (deg)	15	±5	∓10
		Maximum load factor during recovery (g)	1.5	1.5±0.2	1.5±0.5
during recovery					

		:	

26-Nov-96 DEH

2-Axis Upset/Flaperon Hardover

7262

Fligh	Flight Phase	¥	TE	Weather State	State	Failares
7C. Supers	7C. Supersonic Cruise	505. Simulated 2-Axis	ted 2-Axis	1. Light Turb.		112. Two aileron Panels
		Gust Upset, High Speed	High Speed	•		(Asymmetric)
Loading:	.oading: 7. MFC - Final Cruise condition	d Cruise condi	tion			
Head/X	Turb/	Approach	Ceiling/	RWV		
Wind, kt		Category	Visibility	Surface	ı	Initial Position
O Ke	Light	0	Unlimited	Dry.		¥%
0 Kt	None		Unlimited	grooved		

Initial Position	ΝΑ	Abnormals/Exceptions: Flaperon hardover during re upset.
		-
Catching   Visibility	Unlimited Unlimited	O PSCAS NORMAL RSCAS NORMAL A/T HUD OFF FID Confis Ref H Cw 3
	0	R/C 0
	Light/ None	64,000 M 2.4 384,862 53.2 UP
1	0 Kv 0 Kt	ALT 64,000 KEAS/M M 2.4 GW 384,862 C.G. 53.2 GEAR UP LEFTTEF Auto

ecovery from

Abnormals/Exceptions:	NORMAL Abi	CAS NC
	'	
NA	Dry, grooved	Julimited/ Julimited
Initial Positi	Rwy Surface	Ceiling/ /isibility
112. Two ai (Asymmetric	1. Light Turb.	2-Axis gh Speed
State Fai	Weather State	

Pilot: Date:

Runs:

vel Flight (Cruise) without exceptional piloting streng	Ded O SIVE-7		TALL DISCOURS
Evaluation Basis: Maneuver is possible without exceptional piloting strength or skill at Md.  Performance Standards Target Desired Maximum Bank Angle (deg) ±5	Straight and Level Flight (Cruise) Straight Flight		
e Standards Target	neuver is possible without exceptional piloting st	ength or skill and w	ithout exceeding
Maximum Bank Angle (deg) ±5	e Standards T	Desired	Adequate
	(deg) 15	±5	01∓
Maximum load factor during recovery (g) 1.5 [ 1.5±0.2	uring recovery (g) 1.5	1.5±0.2	1.5±0.5

Procedure—Evaluation Pilot (PF):  1. Establish straight and level flight at M 2.4.  2. Reduce throttle to 50% and pull up gently to decelerate to M 2.3.  3. Establish a flight path angle of 6 degrees below the horizon, then roll to a bank angle of 15 degrees.  4. Maintain this autitude for 3 seconds.  5. Roll wings level.  6. Execute a 1.5 g pull-up to recover to level flight. Advance throttles to full to begin acceleration.  7. Terminate the maneuver after all transients have quiesed.  Procedure—Test Engineer / Pilot Not Flying (PNF):	1. Confirm multiple conditions.
---	---------------------------------

Count off 3 seconds after reaching M 2.4 and call out "Recover."
 Trigger flaperon hardover.
 A Call out flaperon hardover.
 Monitor load factor during recovery and provide feedback to PF if necessary to ensure a smooth 1.5 g recovery.

Runs:

Pilot:

## 30' Go-Around with Autoflap Failure

Filgi	it Phase	W	MTE	Weather State	State	Failures
17A. Landing	gui	307. Go-Aro Loss	307. Go-Around - Min Alt 301. Cat Illa - Lt. Turb Loss	301. Cat IIIa	. Lt. Turb	115. All TEF Panels
Loading:	-	ZFW+Body Fu	6. M3F - MZFW+Body Fuel+Wing Fuel, Fwd C.G.	Fwd C.G.		
Head/X		Approach	Ceiling/	Rwy		
Wind, kt	Gusts	Category	>	Surface	=	Initial Position
0 KV	Light/	3A	74 OS	Dry,	On G/S and	On G/S and LOC about 3 miles from
0 Kı	None		900 fr	grooved	touchdo	touchdown, at 750 feet AGL

Abnormals/Exceptions:	All TEF ismmed at landing deflection					
NORMAL		NORMAL		NO		Config Ref H Cyc 3
SO PSCAS		154 RSCAS	Α⁄Τ	HUD	F/D	Config
159		154	159	125		
Vapp		Vref	Vg/a	Vmin		
400	AGL	159	384,862	47.3	N N O O	Auto
ALT		KEAS/M	GW 384	၁.၁	GEAR	LEF/TEF

- Procedure—Evaluation Pilot (PF):

  1. Establish aircraft on LOC and G/S.

  2. Maintain Vapp.

  3. Track LOC and G/S using HUD.

  4. When PNF calls "Go-round" pitch nose up to capture a target flight path angle of 12°, while simultaneously pushing the TO/GA button and advancing throttles to go-around thrust. The time to initially acquire the target flight path angle should be 7 sec.

  5. Terminate test when target climb pitch attitude has been established and stabilized.

- Procedure—Test Engineer / Pilot Not Flying (PNF):

  1. Confirm initial conditions.

  2. During approach, PNF monitors any performance indicators that will not be automatically reported at the confirmation of the run.

  3. At 30 feet radio altitude, call out "Go-Around".

  4. Call out flap failure.

Evaluation Segment:	Evaluation Segment: Minimum Altitude Loss Go-Around	round	Long CHR	Long CHR Lat / Dir CHR
Start Evaluation: End Evaluation:	30' AGL, Final Approach Speed, Descending Stabilized Climb Flight Path	ed, Descending		
<b>Evaluation Basis:</b> Evalu with a minimum of airspo pitch or roll. There shoul	Evaluation Basis: Evaluate the ability to go around from a very low altitude without contacting the runway with a minimum of airspeed loss. For desired performance, there should be no tendency to PIO or bobble in pitch or roll. There should be no geometry strikes	n a very low altituc ce, there should be	de without contac no tendency to P	ting the runway IO or bobble in
Performs	Performance Standards	Target	Desired	Adequate
Overshoot of Target Flight Path (deg)	ht Path (deg)	0	Ŧ3	±3
Altitude Loss (ft)		<20	<20	<30
Bank Angle Control (deg)	(	0	<del>1</del> 5	∓10
Pilot Induced Oscillations	8	No PIO	No PIO	Not Divergent
Geometry Strikes (tail, engine nacelle, wing tip)	ngine nacelle, wing tip)	No Strikes	No Strikes	No Strikes

		1	7286

27-May-97 DEH

Date:

Long CHR | Lat / Dir CHR

Pilot:

Runs:

150-2250 150-2250 127 127 127

Deviation from Approach Airspeed at 50 ft (kt)
Deviation from Runway Heading at touchdown (deg)
Lateral offset from tunway centerline at touchdown (ft)
Lateral offset from tunway centerline at touchdown (ft)
Sink Rate at touchdown (ff/sec)
Maximum Bank Angle below 50 ft AGL (deg)
Pilot Induced Oscillations (PIO)
Geometry Strikes (tail, engine nacelle, wing tip)

±3 1000-1500

Adequate

Desired

Target

Performance Standards

Not Divergent No Strikes

No Strikes

No Strikes

±5 No PIO

15 Kt Crosswind App & Ldg/75% Roll Loss

7291

CHR Itat / Dir C			stformance, there should be no	cy to float of bounce after
Evaluation Segment: Precision I anding	i: 200 ft AGL, Landing Speed, Descending	Nosewheel touchdown	Evaluation Basis: Evaluate handling qualities in landing. For desired performance, there should be no tendency to PIO or habble in nitch or not. There should also be no tendency to PIO or habble in nitch or not.	re should be no geometry strikes on touchdown.
Evaluation S		Caro Evaluation.	Evaluation Bar	touchdown.The
tate Fallures	wind 114. All Flaperon Panels		Initial Position	1/2 mi outside OM, at 1,500 feet AGL, on LOC.
ather State	t Crosswind			-
We	n   30. 15 K		Rwy 7 Surface	Dry, grooved
TE	ete Approac	ition	Celling/ Visibility	Unlimited Unlimited
M	313. Comple and Landing	<ol> <li>MFC - Final Cruise condition</li> </ol>	Approach Category	0
t Phase	Bui	7. MFC - Fint	Turb/ Gusts	Moderate/ None
Fligh	I7A. Land	Loading:	Head/X Wind, kt	0 KV 15 Kt

Abnormals/Exceptions: 75 % loss of roll control during approach.	
	Key in Cyc 3
F-24 \	Course
155 125 125 125	
Vapp Vref Vg/a Vmin	
1,500 1,500 1,500 384,862 53.2 53.2 DOWN	
KEAS/M GW 38 C.G. GEAR D	JOI /JOY

Note: X-wind decreases linearly from 25 kt at 1000 ft AGL to 15 kt at field elevation.

Procedure-Evaluation Pilot (PF):

1. Establish aircraft in steady level flight at the noted conditions, tracking the LOC for G/S intercept.

2. Maintain Vapp.

3. Track LOC fo G/S intercept and capture G/S using HUD or PFD.

4. Procedure A: Disconnect autothrottles at 30 ft AGL, manually retard throttles and initiate a decrab and flare maneuver to touchdown at the target point. Max bank angle 5 deg.

5. Procedure B: At 30 ft AGL, initiate a forward slip (max bank angle 5 deg).

6. Procedure B: Az sounced autothrottles and execute a flare to touchdown at the target point on the runway.

7. Procedure B: Disconnect autothrottles and execute a flare to touchdown at the target point on the runway.

8. Procedure B: Disconnect autothrottles and execute a flare to touchdown at the target point on the runway.

9. After touchdown, retard throttles to idle and lower the nosewheel to the runway.

8. Procedure - Test Engineer / Pilot Not Flying (PNF):

9. Confirm initial conditions.

1. Confirm initial conditions.

that will not be automatically reported at the		Approximate the second	
<ol> <li>During approach, PNF monitors any performance indicators that will not be automatically reported at the end of the run.</li> <li>Call out flaperon failure.</li> </ol>			

Date:

Lat / Dir CHR

Long CHR Runs:

# 15 Kt Crosswind App & Ldg/Flaperon Hardover

7292

Figi	nt Phase	Σ	MTE	Weather State	State	Failures
17A. Landing	ing	313. Comple	te Approach	313. Complete Approach   30, 15 Kt Crosswind	paswind	112. Two aileron Panels
		and Landing				(Asymmetric)
Loading:	7. MFC - Fins	7. MFC - Final Cruise condition	tion			
Head/X	Turb/	Approach	Ceiling/	Rwy		
Wind, kt	Gusts	Category	Visibility	Surface	ä	Initial Position
0 KV	Moderate/	0	Unlimited	Dry,	1/2 mi ou	outside OM, at 1,500 feet
15 Kt	None		Unlimited	grooved	_	AGL, on LOC.

Abnormals/Exceptions:	Flaneron hardover during approach	· imperon macores canning approach.			
NORMAL	NORMAL	Ö	NO O	O.F.	Ref H Cyc 3
PSCAS	RSCAS	A/T	HUD	F/D	Config
159	154	159	125		
Vapp		Vg/a			
1,500	159	384,862	53.2	DOWN	Auto
ALT	KEAS/M	85	ი.ი.	GEAR	LEF/TEF

No Strikes

No PIO

Deviation from Approach Activities at 50 ft (kt)
Deviation from Runway Heading at touchdown (deg)
Longitudinal distance from threshold at touchdown (ft)
Lateral offset from runway centerline at touchdown (ft)
Maximum Bank Angle below 50 ft AGL (deg)
Pilot Induced Oscillations (PIO)
Geometry Strikes (tail, engine nacelle, wing tip)

±5 ±3 1000-1500

Adequate

Desired

Target

Evaluation Basis: Evaluate handling qualities in landing. For desired performance, there should be no tendency to PIO or bobble in pitch or roll. There should also be no tendency to float or bounce after fouchdown. There should be no geometry strikes on touchdown.

200 ft AGL, Landing Speed, Descending Nosewheel touchdown

Precision Landing Pilot:

Evaluation Segment: Start Evaluation: End Evaluation:

Note: X-wind decreases linearly from 25 kt at 1000 ft AGL to 15 kt at field elevation.

Procedure—Evaluation Pilot (PF):  1. Establish aircraft in steady level flight at the noted conditions, tracking the LOC for G/S intercept. 2. Maintain Vapp. 3. Track LOC to G/S intercept and capture G/S using HUD or PFD. 4. Procedure A: Disconnect autothrottles at 50 ft AGL. 5. Procedure A: At 50 ft AGL, manually reard throttles and initiate a decrab and flare maneuver to touchdown at the target point. Max bank angle 5 deg. 6. Procedure B: At 200 ft AGL, initiate a forward slip (max bank angle 5 deg). 7. Procedure B: Disconnect autothrottles at 50 ft AGL. 8. Procedure B: Manually retard throttles and execute a flare to touchdown at the target point on the runway. Max bank angle is 5 deg. 9. After touchdown, retard throttles to idle and lower the nosewheel to the runway. Confirm initial conditions. 1. Confirm initial conditions. 2. During approach, PNF monitors any performance indicators that will not be automatically reported at the end of the run. 3. Call out flaperon hardover.				

### Appendix C. Controls Allocation Document

The attached pages represent the manner in which the control surfaces are utilized to provide flight control functions.

### Appendix C. Controls Allocation for LaRC.1

### Actuator model

The actuator model used for LaRC.1 includes the effect of aerodynamic hinge moments on rate and position authority, and includes blow-back of control surfaces at sufficiently high dynamic pressure and surface extensions.

### Controls Mixer

### Longitudinal

The total pitch command from the control system (both pilot and SAS components) are used to command the elevator and stabilizer in a 2:1 gearing - that is, a 10 degree elevator trailing-edge-up command yields a 5 degree stabilizer trailing-edge-up command.

### Lateral/Directional

For LaRC.1, trailing edge flaps 1, 2, 3 on the left wing and 6, 7, 8 on the right wing are used as flaperons.

### Flap Logic

### Takeoff flap setting

For takeoffs, the flaps are fixed at 30° leading edge and 10° trailing edge (30/10).

### Landing flap setting

The landing flap setting is fixed at 0° leading edge and 30° trailing edge (0/30). If the speedbrake handle is raised prior to touchdown (ground armed position) the flaps will retract at maximum rate when weight-on-wheels is detected.

### Flap extension/retraction logic

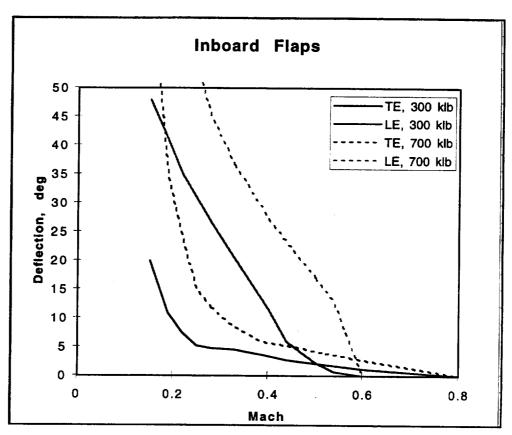
On landing, the flaps convert from automatic to landing settings starting at 390 feet gear height over 18 seconds for most tasks; the decelerating approaches use a different time scale so that the reconfiguration takes place over the entire approach. On takeoff the flaps reconfigure from takeoff to automatic flap schedule starting above 35 ft gear height over a period of 18 seconds. In a go-around situation, the flaps reconfigure from landing settings to the appropriate takeoff or auto schedule over 18 seconds after the TOGA button is depressed.

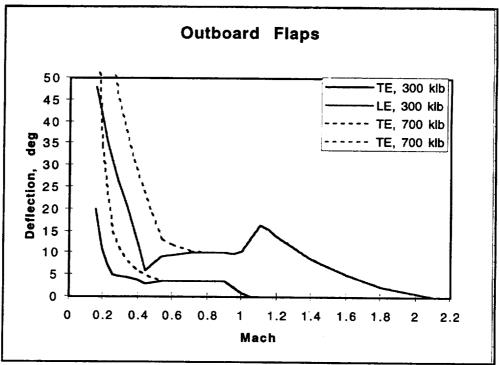
### Autoflap schedule

The automatic flap schedule is used for all flight envelopes except landing and takeoff, or as noted on the flight cards. The schedule was extracted from a document by Brett Churchill of Boeing, and are separate functions of weight and Mach for inboard and outboard leading and trailing edge flaps.

This nominal flap schedule is further modified by a low-speed function, based upon angle of attack. If angle-of-attack goes above a 15 degrees, the automatic flap schedule is modified with a minimum deflection value (a function of angle-of-attack) (not shown).

The nominal (low angle-of-attack) automatic flap schedules are shown below:





### Vortex Fence

The vortex fence is used to assist in improving nose-down trim during landings and assisting in rotation during takeoff. The fence extends during takeoff when Vr is reached and the stick is moved aft of center, and retracts when either the gear is off the ground or desired rotation pitch

attitude is reached. The rotation fence operation is rate limited such that full extension or retraction takes one second while weight is on the wheels, and 3 1/3 seconds if in the air.

During landing, the fence extends over 18 seconds starting at 390 feet gear height in sync with the flap reconfiguration, and stows during landing rollout.

### Spoiler/Slot deflectors

The Spoiler/Slot deflectors (SSDs) are not used for roll control, but are available to function as speedbrake for most tasks.

### Landing mode

In most landing tasks, the speedbrake handle can be armed for ground spoilers by raising the speedbrake handle prior to touchdown. When weight-on-wheels is first detected, the flaps retract and the spoilers extend.

### **Emergency Descent**

In the emergency descent task, the spoilers should be deployed fully. A variable amount of drag can be programmed for the "generic drag device" so that the amount of drag required to perform the emergency descent within the time limits imposed by Federal Aviation Regulations can be studied.

Rate and Position Limits for actuators

Actuator	Rate limit deg/sec	Position negative	limits (deg) positive
Elevator	50	-30	+30
Stabilizer	25	-15	+15
Flaperons*	50	-30	30
LE flaps	15	0	+50
TE flaps 4 & 5	15	0	+30
Rudder	50	-30	+30
Vortex Fence	90	0	+70

<sup>\*(</sup>T.E. 1, 2, 3, 6, 7, 8)

### REPORT DOCUMENTATION PAGE Form Approved OMB No. 0704-0188 Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503. 1. AGENCY USE ONLY (Leave blank) 2. REPORT DATE 3. REPORT TYPE AND DATES COVERED December 1999 Technical Memorandum 4. TITLE AND SUBTITLE 5. FUNDING NUMBERS Reference H Piloted Assessment (LaRC.1) Pilot Briefing Guide WU 537-08-23-21 6. AUTHOR(S) E. Bruce Jackson, David L. Raney, David E. Hahne, and Stephen D. Derry and Louis J. Glaab 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) 8. PERFORMING ORGANIZATION REPORT NUMBER NASA Langley Research Center L-17903 Hampton, VA 23681-2199 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) 10. SPONSORING/MONITORING AGENCY REPORT NUMBER National Aeronautics and Space Administration NASA/TM-1999-209533 Washington, DC 20546-0001 11. SUPPLEMENTARY NOTES 12a. DISTRIBUTION/AVAILABILITY STATEMENT 12b. DISTRIBUTION CODE Unclassified-Unlimited Subject Category 08 Distribution: Nonstandard Availability: NASA CASI (301) 621-0390 13. ABSTRACT (Maximum 200 words) This document describes the purpose of and method by which an assessment of the Boeing Reference H High-Speed Civil Transport design was evaluated in the NASA Langley Research Center's Visual/Motion Simulator in January 1997. Six pilots were invited to perform approximately 60 different Mission Task Elements that represent most normal and emergency flight operations of concern to the High Speed Research program. The Reference H design represents a candidate configuration for a High-Speed Civil Transport, a second generation supersonic civilian transport aircraft. The High-Speed Civil Transport is intended to be economically sound and environmentally safe while carrying passengers and cargo at supersonic speeds with a trans-Pacific range. This simulation study was designated "LaRC.1" for the purposes of planning, scheduling, and reporting within the Guidance and Flight Controls super-element of the High-Speed Research program. The study was based upon Cycle 3 release of the Reference H simulation model. 14. SUBJECT TERMS 15. NUMBER OF PAGES HSR; Ref H; Reference H; Simulation; Flying qualities; MTE; HQ; CHR; HSCT; 100 High-Speed Civil Transport; LaRC.1; GFC; Guidance and Flight Control 16. PRICE CODE A05 17. SECURITY CLASSIFICATION 18. SECURITY CLASSIFICATION 19. SECURITY CLASSIFICATION 20. LIMITATION OF REPORT OF THIS PAGE OF ABSTRACT OF ABSTRACT Unclassified Unclassified Unclassified UL

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